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Similar but diverse: New species and distribution pattern of the pleasing lacewing genus *Dilar* Rambur, 1838 (Neuroptera, Dilaridae) from China

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Abstract

The pleasing lacewing genus *Dilar* Rambur, 1838, albeit possessing largely similar external characters, is the most species-rich genus of the family Dilaridae. This genus is particularly diverse in China, previously with 41 species recorded. Herein, we report eight new species of *Dilar* from China, namely *Dilar jiquanyui* **sp. nov.**, *Dilar lanlingensis* **sp. nov.**, *Dilar lulanae* **sp. nov.**, *Dilar puerensis* **sp. nov.**, *Dilar qiongduensis* **sp. nov.**, *Dilar tuyuezhengi* **sp. nov.**, *Dilar weiningensis* **sp. nov.** and *Dilar yangyingae* **sp. nov.** All these new species occur in the Oriental China and six of them are distributed from southwestern China, reinforcing this region as a key distribution centre of species diversity in *Dilar*. We also summarise the distribution pattern of this genus in China, showing the faunal affinities across different zoogeographic regions within the country. In addition, a key to all Chinese *Dilar* species is provided.

Key Words

Neuropterida, Oriental Region, taxonomy

Introduction

The genus *Dilar* Rambur, 1838, is the most species-rich genus of the pleasing lacewing family Dilaridae, with 87 described extant species distributed across the Palaearctic and Oriental Regions (Liu et al. 2017; Oswald 2025). Over the past decades, the taxonomy of *Dilar* has been extensively revised across multiple regions, including Central Asia, South Asia, East Asia, Southeast Asia, West Asia, parts of Europe and North Africa (Monserrat 2014; Zhang et al. 2014a, 2014b, 2014c, 2015; Aspöck et al. 2015; Martins et al. 2018; Li et al. 2019, 2020; 2021, 2025; Li and Liu 2020). Amongst these regions, China, especially its Oriental Region, has notably emerged as a major hotspot of *Dilar* diversity, exhibiting the highest species richness (Li et al. 2021).

The first species of *Dilar* recorded from China refers to *Dilar formosanus* Okamoto & Kuwayama, 1920 from Taiwan. Later, *Dilar subdolus* Navás, 1932 was reported from southeast China (Jiangsu Province), though the validity of this species remains uncertain due to the loss of the type specimen. Further taxonomic contributions were mainly made by Nakahara (1955, 1957) and Yang (1986, 1987, 1988, 1992, 1999, 2001), who described several new species from various regions of China. In the past decade, Zhang et al. (2014a, b, c, 2015) presented a comprehensive revision of *Dilar* from China, significantly improving the classification of the genus. More recently, Li and Liu (2020) and Li et al. (2021) further expanded the knowledge of the Chinese fauna of *Dilar*, with the addition of eight new species. To date, 41 species of *Dilar* have been recorded from China, making it the most species-rich country for the genus. The highest diversity is concentrated in the Oriental Region of China, particularly in Yunnan Province and adjacent areas, which have been recognised as a primary centre of *Dilar* diversity and endemism (Li et al. 2021).

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In this paper, we describe eight new species of *Dilar* from China, namely *D. jiquanyui* sp. nov., *D. lanlingensis* sp. nov., *D. lulanae* sp. nov., *D. puerensis* sp. nov., *D. qiongduensis* sp. nov., *D. tuyuezhengi* sp. nov., *D. weiningensis* sp. nov. and *D. yangyingae* sp. nov. These new species were all collected in the last five years. Notably, six of them occur in south-western China, which reinforces the region as a key centre of the species diversity of the genus. Furthermore, the distribution pattern of the Chinese species is summarised and their faunal affinities across different zoogeographic regions are discussed. An updated key to the species of *Dilar* from China is also provided.

Material and methods

Taxonomy

The specimens examined herein are deposited in the Entomological Museum, China Agricultural University (CAU), Beijing, China.

Genitalic preparations were made by clearing the apex of the abdomen with potassium hydroxide (KOH) in 120 °C for about 6–8 minutes. After rinsing the KOH with distilled water, the apex of the abdomen was transferred to glycerine for further examination. Habitus photos of adults were taken by using a Nikon D800 digital camera with Nikon MICRO NIKKOR 105 mm lens. The photos of genitalia were taken by using the Nikon D800 with Leica DM 2000 optical microscope and the genitalic figures were drawn by hand using a Nikon SMZ745 stereomicroscope. All images were processed and arranged with Adobe Photoshop 2021. Labels for the figure plates were created in Adobe Illustrator 2021.

The terminology of wing venation generally follows Adams (1970) and Kukalová-Peck and Lawrence (2004). Terminology of the genitalia generally follows U. Aspöck and H. Aspöck (2008). The abbreviations used for wing veins are as follows: A, anal vein (here: A1, A2, A3); C, costa; CuA, cubitus anterior; CuP, cubitus posterior; MA, media anterior; MP, media posterior; R, radius; Rs, radius sector; Sc, subcosta.

Distribution map

The distribution maps were made by ArcGIS 10.2. The distribution data were summarised from a total of 186 coordinate records of 49 species of *Dilar* in China (main dataset available in Li et al. (2021)). Faunal analysis is conducted, based on the zoogeographical division of China (Zhang 1999). The division of zoogeographical regions of China encompasses: I. North-eastern China Region; II. North China Region; III. Mongo-Xinjiang Region; IV. Qinghai-Xizang Region; V. South-western China Region; VI. Mid-China Region; VII. South China Region (including Hainan and Taiwan Islands and adjacent islands).

Results

Taxonomy

Genus *Dilar* Rambur, 1838

Dilar Rambur, [1838] 1837–1840: pl. 9, figs 4, 5. **Type species:** *Dilar nevadensis* Rambur, [1838] 1837–1840: pl. 9 (monotypy).

Cladocera Hagen, 1860: 56. Nomen nudum.

Lidar Navás, 1909: 153. Type species: *Dilar meridionalis* Hagen, 1866: 295 (original designation).

Fuentenus Navás, 1909: 154. Type species: *Dilar campestris* Navás, 1903: 380 (original designation).

Rexavius Navás, [1909] 1908–1909: 664. Type species: *Dilar nietneri* Hagen, 1858: 482 (designated by Navás 1914: 10).

Nepal Navás, [1909] 1908–1909: 661. Type species: *Nepal harmandi* Navás, [1909] 1908–1909: 661 (original designation).

Notes. See detailed diagnosis of *Dilar* and current distribution in Li et al. (2021). The Chinese species of *Dilar* are divided into five species-groups in Zhang et al. (2015). Here, by adding new species published after Zhang et al. (2015), we re-classify the species-groups in China and propose a new species-group. A total of six *Dilar* species-groups are currently recorded in China, as follows:

1. The *Dilar hastatus* species-group: 16 species are recorded from China, i.e. *D. bifurcatus* Zhang, Liu, H. Aspöck & U. Aspöck, 2015, *D. chebalingensis* Zhang, Liu, H. Aspöck & U. Aspöck, 2015, *D. hastatus* Zhang, Liu, H. Aspöck & U. Aspöck, 2014, *D. longidens* Zhang, Liu, H. Aspöck & U. Aspöck, 2015, *D. maoershanensis* Zhang, Liu, H. Aspöck & U. Aspöck, 2015, *D. pallidus* Nakahara, 1955, *D. septentrionalis* Navás, 1912, *D. sinicus* Nakahara, 1957, *D. stenopterus* Yang, 1999, *D. taibaishanus* Zhang, Liu & H. Aspöck & U. Aspöck, 2014, *D. taiwanensis* Banks, 1937, *D. tianmuanus* Yang, 2001, *D. wuyianus* Yang, 1999, *D. lanlingensis* sp. nov., *D. tuyuezhengi* sp. nov. and *D. yangyingae* sp. nov. This species-group is characterised by the proximally inflated male gonocoxite 9, with unguiform or bifid tip and by the slender elongate male gonocoxite 10, which is generally much longer than gonocoxite 9.
2. The *Dilar guangxiensis* species-group: 10 species are recorded from China, i.e. *D. dulongjiangensis* Zhang, Liu, H. Aspöck & U. Aspöck, 2015, *D. geometroides* H. Aspöck & U. Aspöck, 1968, *D. guangxiensis* Zhang, Liu, H. Aspöck & U. Aspöck, 2015, *D. harmandi* (Navás, 1909), *D. insularis* Zhang, Liu, U. Aspöck in Zhang et al. 2014, *D. lulanae* sp. nov., *D. tibetanus* Yang, 1987, *D. yangi* Zhang, Liu, H. Aspöck & U. Aspöck, 2015, *D. yucheni* Li, H. Aspöck, U. Aspöck & Liu, 2021and *D. zhangweiae* Li, H. Aspöck, U. Aspöck & Liu, 2021. This species-group is characterised by the male tergum 9 with a posteromedial projection (= dorsoprocessus), which is generally cone-shaped

and by the male gonocoxite 10 generally with a pointy lobe connecting to gonocoxite 9 submedially.

3. The *Dilar yunnanus* species-group: Three species are recorded from China, i.e. *D. dongchuanus* Yang, 1986, *D. megalopterus* Yang, 1986 and *D. yunnanus* Yang, 1986. This species-group is characterised by the strongly inflated male gonocoxite 9 with unguiform or bifid tip and by the fused male gonocoxites 11 nearly W-shaped, with median portion convex posteriad.
4. The *Dilar lijiangensis* species-group: Four species are recorded from China, i.e. *D. lijiangensis* Zhang, Liu, H. Aspöck & U. Aspöck, 2015, *D. nobilis* Zhang, Liu, H. Aspöck & U. Aspöck, 2015, *D. weibaoshanensis* Li, H. Aspöck, U. Aspöck & Liu, 2021 and *D. puerensis* sp. nov. This species-group is characterised by the slender elongate male gonocoxite 9, which is inflated at base and by the slender elongate male gonocoxite 10, which are bifurcated submedially.
5. The *Dilar spectabilis* species-group: Four species are recorded from China, i.e. *D. montanus* Yang, 1992, *D. muliensis* Li & Liu, 2020, *D. spectabilis* Zhang, Liu, H. Aspöck & U. Aspöck, 2014 and *D. qiongduensis* sp. nov. This species-group is characterised by the generally dark wings, the male gonocoxite 10 submedially with an additional flake-like lobe connecting to gonocoxite 9 and the male ectoproct with a pair of laterally curved unguiform projections at tip.
6. The *Dilar caesarulus* species-group: Only one species is recorded from China, i.e. *D. kirgisus* H. Aspöck & U. Aspöck, 1967. Notably, this species-group is primarily distributed in Central Asia. Apart from *D. kirgisus*, there are other four members, i.e. *Dilar caesarulus* H. Aspöck & U. Aspöck, 1967, *Dilar dochaner* H. Aspöck & U. Aspöck, 1968, *Dilar hornei* McLachlan, 1869 and *Dilar vartianorum* H. Aspöck & U. Aspöck, 1967. This species-group is characterised by the densely-spotted forewings, the male tergum 9 with a nearly rectangular posteromedial projection (= dorsoprocessus), the male ectoproct with a slightly convex anterior margin and lateral prominences, the male gonocoxite 9 acutely narrowed distad and the strongly arched fused male gonocoxites 11.

However, the remaining 11 species from China, i.e. *D. canyuanensis* Li, H. Aspöck, U. Aspöck & Liu, 2021, *D. cornutus* Zhang, Liu, H. Aspöck & U. Aspöck, 2015, *D. daweishanensis* Li, H. Aspöck, U. Aspöck & Liu, 2021, *D. jiquanyui* sp. nov., *D. lii* Zhang, Liu, H. Aspöck & U. Aspöck, 2015, *D. maculosus* Zhang, Liu, H. Aspöck & U. Aspöck, 2015, *D. nujianganus* Li, H. Aspöck, U. Aspöck & Liu, 2021, *D. weiningensis* sp. nov., *D. punctulosus* Li & Liu, 2020, *D. subdolus* Navás, 1932 and *D. formosanus* (Okamoto & Kuwayama, 1920) cannot be assigned to any of these species-groups above.

Key to species of *Dilar* from China, based on male characters

1 Tergum 9 dorsally with a posteromedial projection (= dorsoprocessus) 2
– Tergum 9 dorsally without posteromedial projection (= dorsoprocessus) 12
2 Tergum 9 with a rectangular dorsoprocessus (H. Aspöck and U. Aspöck 1967: fig. Abb.3; Li et al. 2019: fig. 36); ectoproct with anterior margin slightly convex (Li et al. 2019: fig. 36) (*Dilar caesarulus* species-group) ..... *D. kirgisus*
– Tergum 9 generally with a cone-shaped dorsoprocessus; ectoproct with anterior margin generally with broad or abrupt incision (*Dilar guangxiensis* species-group) 3
3 Forewing with many irregularly arranged and scattered small spots (Zhang et al. 2015: fig. 8; Zhang et al. 2014b: figs 1 and 2) 4
– Forewing with many stripes arranged as transversely arcuate pattern (Zhang et al. 2015: figs 9 and 10; Zhang et al. 2014b: fig. 3; Zhang et al. 2014c: fig. 6) 6
4 Ectoproct posterodorsally with a pair of unguiform, ventrally curved projections 5
– Ectoproct posterodorsally with a pair of subtriangular and flattened projections (Zhang et al. 2015: fig. 50) ..... *D. dulongjiangensis*
5 Gonocoxite 10 slenderly elongate in dorsal view; fused gonocoxites 11 slender beam-shaped in dorsal view (Zhang et al. 2014b: fig. 4) ..... *D. geometroides*
– Gonocoxite 10 rather short in dorsal view; fused gonocoxites 11 with a pair of elongate spinous projections extending laterally in dorsal view (Zhang et al. 2014b: fig. 8) ..... *D. harmandi*
6 Gonocoxite 10 proximally strongly incurved in dorsal view 7
– Gonocoxite 10 proximally nearly straight in dorsal view 8
7 Ectoproct posterodorsally with two pairs of differently lengthened, pointy projections in dorsal view (Zhang et al. 2015: fig. 60) ..... *D. yangi*
– Ectoproct posterodorsally with two pairs of laterally curved, unguiform projections, which are of similar length (Zhang et al. 2014c: fig. 24) ..... *D. insularis*
8 Ectoproct posterodorsally with three tiny teeth (Fig. 4) ..... *Dilar lulanae* sp. nov.
– Ectoproct posterodorsally with a pair of unguiform or cornute projections 9

9 Ectoproct posteroventrally with one bifid digitiform projections (Zhang et al. 2015: figs 55 and 57); in dorsal or ventral views, gonocoxite 10 with truncate tip (Zhang et al. 2015: figs 54 and 55) ..... *D. guangxiensis*
– Ectoproct posteroventrally with one digitiform projections, which is not bifid; in dorsal or ventral views, gonocoxite 10 with unguiform or pointed tip 10
10 Forewing without an immaculate area present distad from median nygma (Zhang et al. 2014b: fig. 3); gonocoxite 10 with spinous base (Zhang et al. 2014b: fig. 13) ..... *D. tibetanus*
– Forewing with a small immaculate area present distad from median nygma (Li et al. 2021: figs 2F and 2G); gonocoxite 10 with slightly swollen, obtuse base 11
11 Posteromedial projection (= dorsoprocessus) of tergum 9 cone-shaped (Li et al. 2021: fig. 14F); gonocoxite 10 not bifurcated on distal half (Li et al. 2021: fig. 14g) ..... *D. yucheni*
– Posteromedial projection (= dorsoprocessus) of tergum 9 posteriorly widened and truncate (Li et al. 2021: fig. 15F); gonocoxite 10 bifurcated on distal half (Li et al. 2021: fig. 15G) ..... *D. zhangweiae*
12 Gonocoxite 10 slenderly elongate, which is generally much longer than gonocoxite 9 (*Dilar hastatus* species-group)... 13
– Gonocoxite 10 shorter or nearly as long as gonocoxite 9 28
13 Gonocoxite 9 bifurcated distad 14
– Gonocoxite 9 not bifurcated distad 20
14 Gonocoxite 9 bifurcated at tip..... 15
– Gonocoxite 9 bifurcated distad from mid-length..... 17
15 Ectoproct in dorsal view nearly semicircular, posterodorsally with a pair of short and flattened projections (Zhang et al. 2014a: fig. 30) ..... *D. taibaishanus*
– Ectoproct in dorsal view nearly trapezoidal, serrate at tip 16
16 Bifurcated gonocoxite 10 with outer lobe strongly curved laterally (Zhang et al. 2015: fig. 24); fused gonocoxites 11 slightly expanded on both ends (Zhang et al. 2015: fig. 25) ..... *D. chebalingensis*
– Bifurcated gonocoxite 10 with outer lobe directed posteriorly (Zhang et al. 2015: fig. 32); fused gonocoxites 11 not expanded on both ends (Zhang et al. 2015: fig. 33) ..... *D. maoershanensis*
17 Gonocoxite 9 not strongly incurved; gonocoxite 10 nearly twice as long as gonocoxite 9 18
– Gonocoxite 9 strongly incurved medially (Zhang et al. 2015: fig. 36); gonocoxite 10 longer than gonocoxite 9..... 19
18 Ectoproct posterodorsally without projections (Zhang et al. 2015: fig. 20); gonocoxite 10 submedially not expanded (Zhang et al. 2015: fig. 21)..... *D. bifurcatus*
– Ectoproct posterodorsally with a pair of obtuse and a pair of spine-like projections (Fig. 6); gonocoxite 10 submedially slightly expanded, forming a narrow rectangular lobe (Fig. 7)..... *Dilar tuyuezhengi* sp. nov.
19 Ectoproct posterodorsally with a strong sclerotised projection medially, which is bifid at tip; gonocoxite 10 in ventral view submedially with a tiny lobe (Zhang et al. 2014c: fig. 17) ..... *D. taiwanensis*
– Ectoproct posterodorsally without median projections (Zhang et al. 2015: fig. 36); gonocoxite 10 in ventral view submedially with a falcate lobe on inner side (Zhang et al. 2015: fig. 37) ..... *D. stenopterus*
20 Gonocoxite 9 rather short, subtriangular..... 21
– Gonocoxite 9 slenderly elongate, inflated proximally 22
21 Ectoproct posterodorsally with a pair of short and flattened projections (Zhang et al. 2014a: fig. 18); gonocoxite 10 in lateral view slightly curved dorsally (Zhang et al. 2014a: fig. 20)..... *D. sinicus*
– Ectoproct posterodorsally with a pair of slenderly elongate projections (Fig. 9); gonocoxite 10 in lateral view curved ventrally (Fig. 9) ..... *Dilar yangyingae* sp. nov.
22 Gonocoxite 10 slenderly elongate, nearly twice as long as gonocoxite 9 23
– Gonocoxite 10 nearly as long as gonocoxite 9 26
23 Ectoproct posterodorsally with a single digitiform projection in middle; gonocoxite 10 with hook-like base 24
– Ectoproct posterodorsally without digitiform projection in middle; gonocoxite 10 with slightly curved or straight base...25
24 Proximal half of gonocoxite 9 almost rectangular, with smooth and straight anterior margin (Fig. 3) .... *Dilar lanlingensis* sp. nov.
– Proximal half of gonocoxite 9 with strongly concaved anterior margin (Zhang et al. 2014a: fig. 12)..... *D. septentrionalis*
25 Forewing with dense discrete small spots (Zhang et al. 2014a: fig. 1); ectoproct posterodorsally with a pair of short and flattened projections (Zhang et al. 2014a: fig. 6)..... *D. hastatus*
– Forewing with many transverse stripes (Zhang et al. 2015: fig. 3); ectoproct in dorsal view with a pair of small unguiform projections at tip (Zhang et al. 2015: fig. 28)..... *D. longidens*
26 Fused gonocoxites 11 strongly expanded on both ends (Zhang et al. 2015: figs 40, 41)..... *D. tianmuanus*
– Fused gonocoxites 11 slender, not expanded on both ends..... 27
27 Forewing nearly hyaline, with no distinct dark markings (Zhang et al. 2014c: fig. 5); ectoproct medially with a subrectangular projection terminating in three sharply-pointed processes (Zhang et al. 2014c: fig. 23) ..... *D. pallidus*
– Forewing yellowish-brown, with distinct brown markings (Zhang et al. 2015: fig. 7); ectoproct medially without a subrectangular projection (Zhang et al. 2015: fig. 44) ..... *D. wuyianus*

28 Gonocoxite 10 submedially with an additional flake-like lobe connecting to gonocoxite 9 (*Dilar spectabilis* species-group) 29
– Gonocoxite 10 submedially without any additional lobe 32
29 Gonocoxite 9 slenderly elongate, with tip inflated and unguiform 30
– Gonocoxite 9 with tapering, spinous tip 31
30 Ectoproct with posterodorsal projection shorter than posteroventral projection (Li and Liu 2020 fig. 11); gonocoxite 9 with slightly swollen tip (Li and Liu 2020: fig. 13) ..... *D. muliensis*
– Ectoproct with posterodorsal projection slightly longer than posteroventral projection (Zhang et al. 2015: fig. 88); gonocoxite 9 strongly inflated at tip (Zhang et al. 2015: figs 89, 90) ..... *D. montanus*
31 Gonocoxite 9 with proximal half slightly inflated in dorsal view (Zhang et al. 2014a: fig. 24) ; fused gonocoxites 11 beam-shaped (Zhang et al. 2014a: figs 24, 25) ..... *D. spectabilis*
– Gonocoxite 9 with proximal half strongly inflated in dorsal view (Fig. 6); fused gonocoxites 11 W-shaped (Fig. 6) ..... *Dilar qiongduensis* sp. nov.
32 Gonocoxite 10 slenderly elongate, and bifurcated submedially (*Dilar lijiangensis* species-group) 33
– Gonocoxite 10 not bifurcated 36
33 Forewing transparent, sparsely spotted (Zhang et al. 2015: fig. 14); ectoproct posterodorsally with a pair of unguiform projections which is not bifid at tip (Zhang et al. 2015: fig. 76) ..... *D. lijiangensis*
– Forewing with numerous brown spots; ectoproct posterodorsally with two pairs of projections 34
34 Ectoproct posterodorsally with two pairs of unguiform projections (Zhang et al. 2015: fig. 82); gonocoxite 10 with hook-like base and digitiform outer distal lobe (Zhang et al. 2015: fig. 83) ..... *D. nobilis*
– Ectoproct posterodorsally with a digitiform projection and a pair of unguiform projections; gonocoxite 10 proximally not hook-like, outer distal lobe spinous or bifurcated 35
35 Gonocoxite 10 with rod-like proximal half, outer distal lobe bifurcated (Li et al. 2021: fig. 13H) ..... *D. weibaoshanensis*
– Gonocoxite 10 with tapering base, outer distal lobe falcate, not bifurcated (Fig. 5) ..... *Dilar puerensis* sp. nov.
36 Fused gonocoxites 11 nearly W-shaped, with median portion convex posteriad (*Dilar yunnanus* species-group) 37
– Fused gonocoxites 11 slender beam-shaped, with median portion not convex posteriad 39
37 Gonocoxite 9 bifurcated at tip (Zhang et al. 2015: fig. 68) ..... *D. megalopterus*
– Gonocoxite 9 not bifurcated at tip 38
38 Ectoproct posterodorsally with a pair of unguiform projections curved ventrad (Zhang et al. 2015: fig. 64) ..... *D. dongchuanus*
– Ectoproct posterodorsally truncate in dorsal view, with medial portion serrate at tip (Zhang et al. 2015: fig. 72) ..... *D. yunnanus*
39 Forewing sparsely spotted, almost hyaline (Zhang et al. 2015: fig. 18) ..... *D. lii*
– Forewing with many brown markings 40
40 Gonocoxite 9 with unguiform tip curved laterally (Zhang et al. 2015: fig. 102) ..... *D. maculosus*
– Gonocoxite 9 with unguiform or spinous tip curved medially 41
41 Gonocoxite 10 with proximal part strongly incurved at nearly right angle 42
– Gonocoxite 10 with proximal part slightly or not incurved 45
42 Gonocoxite 9 with slender elongate, spinous tip 43
– Gonocoxite 9 with unguiform tip 44
43 Gonocoxite 10 longer than gonocoxite 9, with spinous tip, lateral margin without any additional lobe (Li et al. 2021: fig. 4) ..... *D. canyuanensis*
– Gonocoxite 10 almost as long as gonocoxite 9, with lamellar tip, lateral margin with a spinous lobe (Fig. 2) ..... *Dilar jiquanyui* sp. nov.
44 Gonocoxite 9 subdistal with a tiny projection on lateral margin (Fig. 8); gonocoxite 10 subdistally with a blade-like lobe (Fig. 8) ..... *Dilar weiningensis* sp. nov.
– Gonocoxite 9 subdistally without any additional projection (Li and Liu 2020: fig. 19); gonocoxite 10 subdistally with a falcate lobe (Li and Liu 2020: fig. 20) ..... *D. punctulosus*
45 Ectoproct with a projection deeply bifurcated at central part of dorsal sclerite (Li et al. 2021: fig. 9); gonocoxite 10 swollen on distal half, submedially without projections (Li et al. 2021: fig. 9) ..... *D. nujianganus*
– Ectoproct without any projection at central part of dorsal sclerite; gonocoxite 10 tapering distally, submedially with a tiny projection connecting with gonocoxite 9 46
46 Gonocoxite 9 proximally with a foliate lobe and lamellar tip (Li et al. 2021: fig. 5) ..... *D. daweishanensis*
– Gonocoxite 9 proximally swollen, without additional lobe, distally with unguiform tip (Zhang et al. 2015: fig. 94) ..... *D. cornutus*

* *Dilar subdolus* is a nomen dubium and *Dilar formosanus* is only known as female, with unclear specific identity. Therefore, these two species are not included in this key.

Dilar jiquanyui sp. nov.

https://zoobank.org/247459CD-A7D1-4B71-AFB2-D15636D8CEC4

Fig. 2

Common name. 季权宇栉角蛉

Diagnosis. The new species is characterised by the forewing with many short, arcuate stripes throughout which is darker on the proximal 1/4 (Fig. 2A) and by the largely triangular male gonocoxite 9 (Fig. 2B, F) and male gonocoxite 10 with an additional slender elongated, spinous lateral projection at middle (Fig. 2C, G).

Description. Male. Body length 6.0 mm; forewing length 8.5 mm, hindwing length 7.2 mm.

Head generally brown, with yellow setose tubercles, tubercles surrounded by dark brown markings; vertex brown. Compound eyes blackish-brown. Antenna brown; flagellum pectinate, medial branches longer than those branches at base, longest branch nearly 4.0 times as long as corresponding flagellomere, distal seven flagellomeres simple.

Thorax brown; pronotum with a pair of pale brown ovoid tubercles at middle, tubercles surrounded by dark brown markings; mesonotum darker at middle, as well as along anterior, posterior and lateral margins; metanotum much paler than mesonotum. Legs generally pale brown, but protibiae entirely brown, femora, tibiae and each tarsomere dark brown at tip. Wings pale brown (Fig. 2A). Forewing 2.3 times as long as wide, with many short, arcuate stripes throughout, which is darker on the proximal 1/4; two nygmata present at base and middle, median nygma surrounded by a brown spot; longitudinal veins pale yellow, interrupted by many brown spots; crossveins pale brown. Hindwing 2.1 times as long as wide, almost entirely pale brown, with less markings than forewing.

Abdomen brown. Tergum 9 in dorsal view with an arcuate incision, a nearly V-shaped posterior incision, leaving a pair of subtriangular hemitergites, which are obtuse distally and densely setose. Sternum 9 approximately half as long as tergum 9, convex posteriad (Fig. 2G). Ectoproct in dorsal view nearly trapezoidal, with a slightly arcuate anterior incision; posterodorsally with a pair of unguiform projections laterally (Fig. 2F), posteroventrally with a pair of digitiform projections and two pairs of tiny, unguiform projections (not clearly visible in ventral view, but distinct in caudal view) (Fig. 2E, I). Gonocoxite 9 slender elongate, nearly triangular in dorsal view, proximal half with a longitudinal sclerite at middle connecting to gonocoxite 10, the proximal 1/3 with a spinous projection on lateral margin, distally strongly sclerotised and spinous (Fig. 2B, F). Gonocoxite 10 slightly shorter than gonocoxite 9, with thin, strongly incurved base and lamellar tip, and the proximal 1/3 producing a strongly sclerotised, spinous lateral projection, which curving medially (Fig. 2C, G). Fused gonocoxites 11 nearly beam-shaped, laterally slightly curved anteriorly, connecting to bases of gonocoxite 9 (Fig. 2B, F). Hypandrium internum large, nearly trapezoidal, with lateral margins slightly arcuate (Fig. 2C, G).

Material examined. ***Holotype*** ♂, China • Yunnan Province, Dali, Baizu State, Heqing County [白族自治州鹤庆县], 26.236614°N, 100.170742°E, 2401 m alt., 26.V.2023, Quanyu Ji (CAU).

Etymology. The new species is dedicated to Mr. Quanyu Ji, who collected the type specimen.

Distribution. China (Yunnan).

Remarks. The new species resembles *D. cangyuanensis* in having similar male genital characters, for example, the trapezoidal ectoproct, the large subtriangular gonocoxite 9 with inflated base and spinous tip, the gonocoxite 10 with slender, strongly incurved base, the fused gonocoxites 11 with lateral ends angulately curved towards anteriad. However, the new species can be distinguished from the latter by the inconspicuous immaculate area distad to the median nygma (Fig. 2A) and the gonocoxite 9 and 10, respectively producing a spinous projection on lateral margin at the proximal 1/3 (Fig. 2B, C, F, G). However, in *D. cangyuanensis*, the forewing has a broad immaculate area present distad from the median nygma (Li et al. 2021: fig. 1A) and there are no additional lateral projections of male gonocoxites 9 and 10 (Li et al. 2021: fig. 4).

Dilar lanlingensis sp. nov.

https://zoobank.org/FCF878E6-F926-48A3-9F9E-B07CFDE743DE

Figs 1, 3

Common name. 兰陵栉角蛉

Diagnosis. The new species is characterised by the forewing with densely transverse arcuate stripes, which is darker on the proximal half and costal region (Fig. 3A) and by the male ectoproct posterodorsally with a strong sclerotised projection medially, which is bifid at tip (Fig. 3B, F), by the male gonocoxite 9 with posterior half not incurved in dorsal view (Fig. 3B) and by the male fused gonocoxites 11 bifurcated on both ends (Fig. 3B, F).

Description. Male. Body length 6.5 mm; forewing length 10.1 mm, hindwing length 8.9 mm.

Head generally pale brown, with yellow setose tubercles, tubercles surrounded by dark brown markings; vertex brown; region between the antennae distinctly darker. Compound eyes blackish-brown. Antenna generally brown, pedicellus pale yellow; flagellum pectinate, medial branches longer than those branches at base, longest branch nearly 4.0 times as long as corresponding flagellomere, distal seven flagellomeres simple.

Thorax brown; pronotum with a pair of pale brown ovoid tubercles at middle; mesonotum darker along anterior, posterior and lateral margins, submedially with paired pale semi-lunar-like markings; metanotum much paler than mesonotum, with posterior margin much darker. Legs generally pale brown, femora, tibiae and each tarsomere dark brown at tip. Wings pale brown (Fig. 3A). Forewing 2.1 times as long as wide, with many transversely arcuate stripes, markings darker on the proximal half, costal and subcostal region; two nygmata present at base and middle, median nygma surrounded by a brown spot; longitudinal veins pale

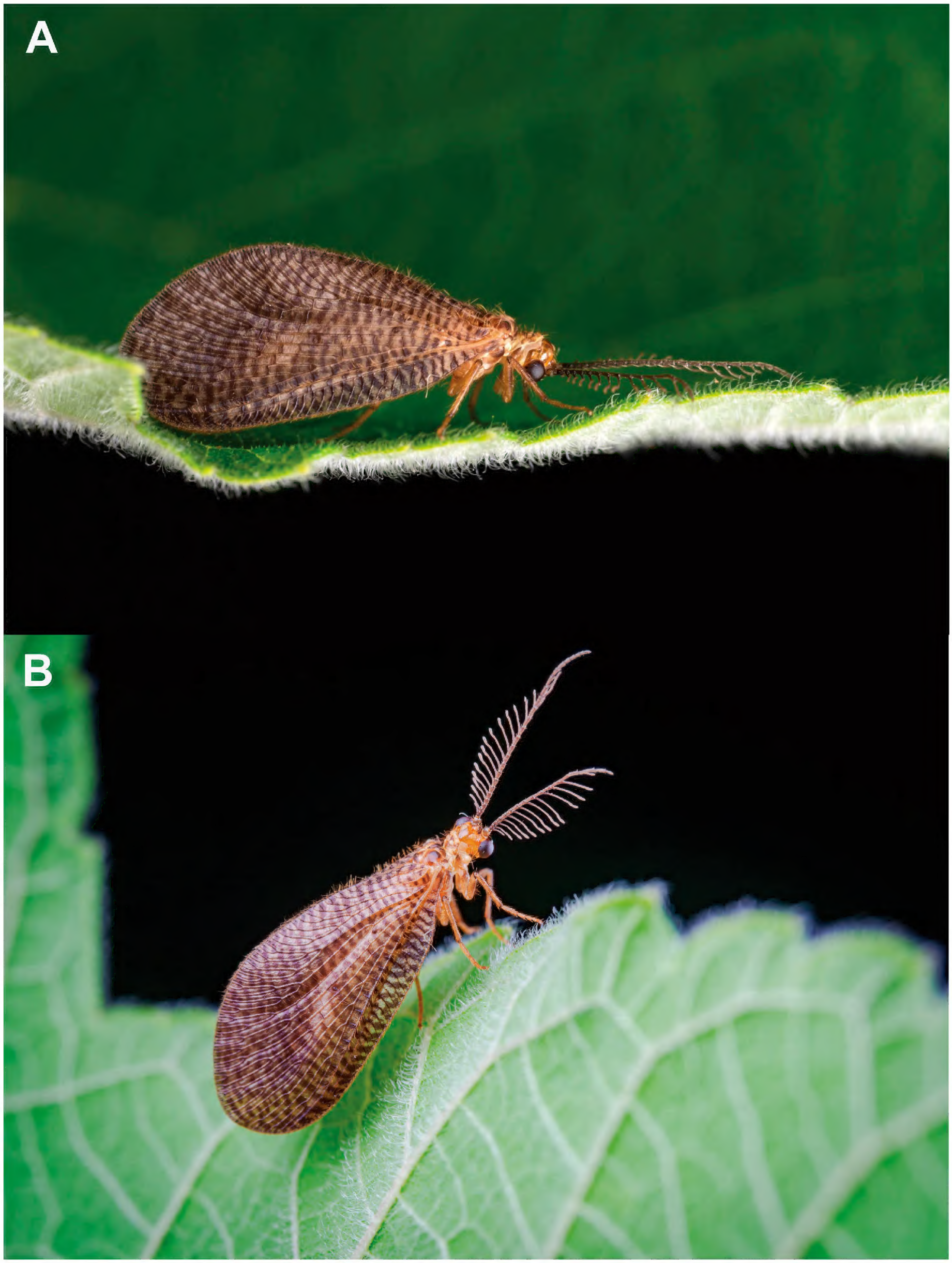

Figure 1. Living males of *Dilar lanlingensis* sp. nov. from Mt. Jintanmaoshan. **A.** Photographed by Tianjiao Wang; **B.** Photographed by Zhe Yu.

yellow, interrupted by many brown spots; crossveins pale brown. Hindwing 2.1 times as long as wide, almost entirely pale brown, with less markings than forewing.

Abdomen brown. Tergum 9 in dorsal view with an arcuate incision and a nearly V-shaped posterior incision, leaving a pair of subtriangular hemitergites, which are

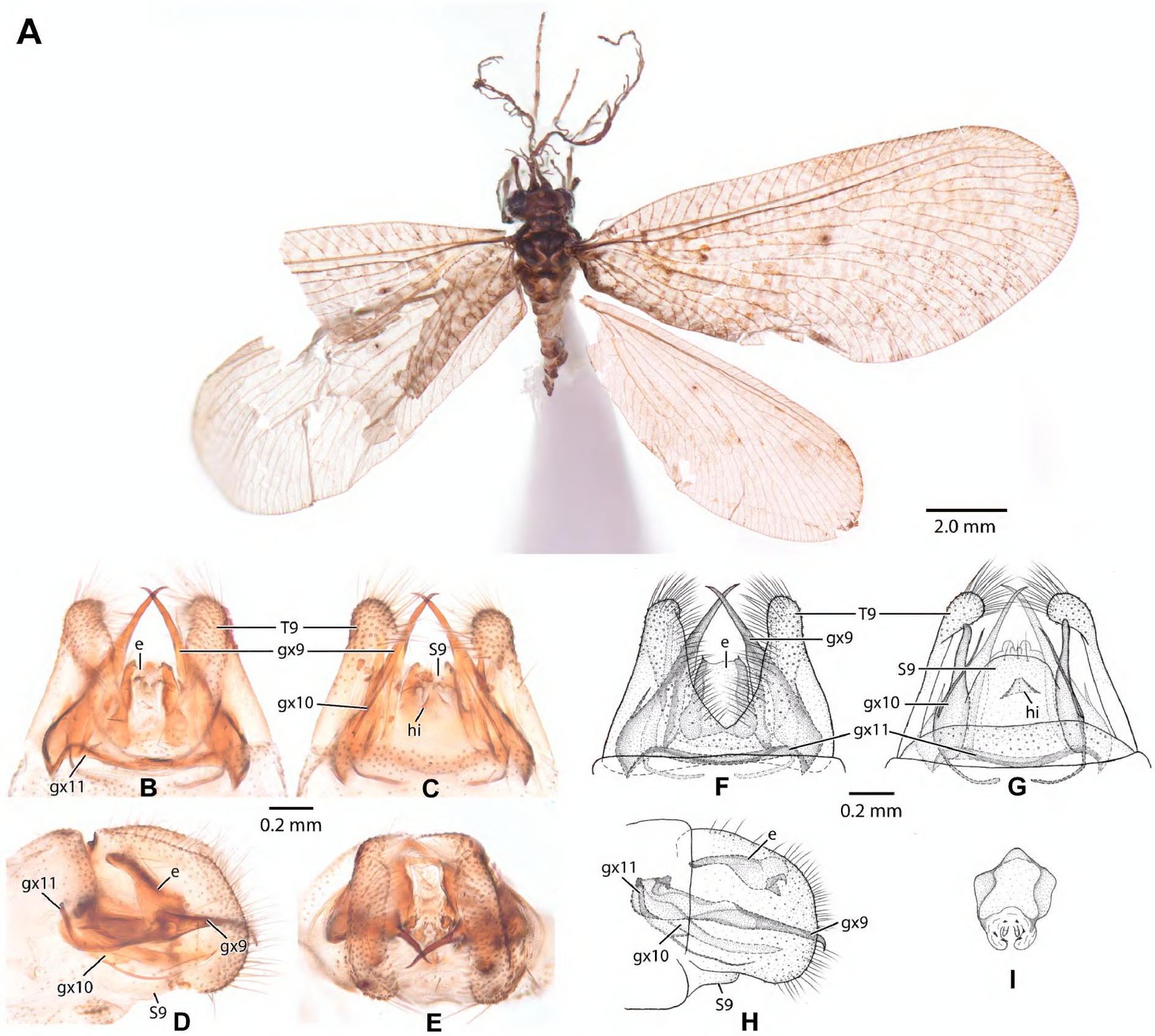

Figure 2. *Dilar jiquanyui* sp. nov., male holotype. **A.** Habitus photo; **B–E.** Genitalia, photographs: **B.** Dorsal view; **C.** Ventral view; **D.** Lateral view; **E.** Caudal view; **F–I.** Genitalia, line drawings: **F.** Dorsal view; **G.** Ventral view; **H.** Lateral view; **I.** Ectoproct, caudal view. Abbreviations: e: ectoproct; gx9: gonocoxite 9; gx10: gonocoxite 10; gx11: fused gonocoxites 11; hi: hypandrium internum; S9: sternum 9; T9: tergum 9. Scale bars: (**A**) 2.0 mm; (**B–E**) 0.2 mm; (**F–I**) 0.2 mm.

obtuse distally and densely setose; the posteromedian region of tergum 9 slightly convex, with a longitudinal sclerotised area present at the median. Sternum 9 subtriangular, approximately one third in length of tergum 9 (Fig. 3G, H). Ectoproct longitudinally elongated, with a deeply arcuate anterior incision; posterodorsally with a digitiform projection, which is bifid at tip (Fig. 3B, F), posteroventrally with a pair of bifid, unguiform projections (Fig. 3I). Gonocoxite 9 with anterior half broadly spoon-shaped, with posterior half slender elongate and curved posteroventrally (Fig. 3B, F); Gonocoxite 10 slender elongate, much longer gonocoxite 9, with incurved base and spinous tip, posterodorsally directed, medially with a robust lobe connecting to ninth gonocoxite (Fig. 3C, G). Fused gonocoxites 11 nearly beam-shaped, laterally bifurcated and angularly posteriorly curved, connecting to bases of gonocoxite 9 (Fig. 3B, F). Hypandrium internum large, nearly trapezoidal, with lateral margins slightly arcuate (Fig. 3C, G).

Material examined. ***Holotype*** ♂, China • Jiangsu Province, Changzhou, Mt. Jintanmaoshan [常州金坛茅山], 18.V.2024, Tiangjiao Wang & Zhe Yu (CAU).

Etymology. The species name refers to the type locality, Changzhou, Jiangsu Province, China. In ancient times, this region was part of the Lanling Commandery [兰陵郡], established during the Southern and Northern Dynasties (circa 502 AD). The administrative centre of Lanling Commandery was located within the present boundaries of modern Changzhou. Over time, the name "Lanling" was gradually replaced by "Changzhou" due to changes in administrative divisions, but the historical name remains significant. The specific epithet honours this ancient connection to Lanling, where the type specimen was collected.

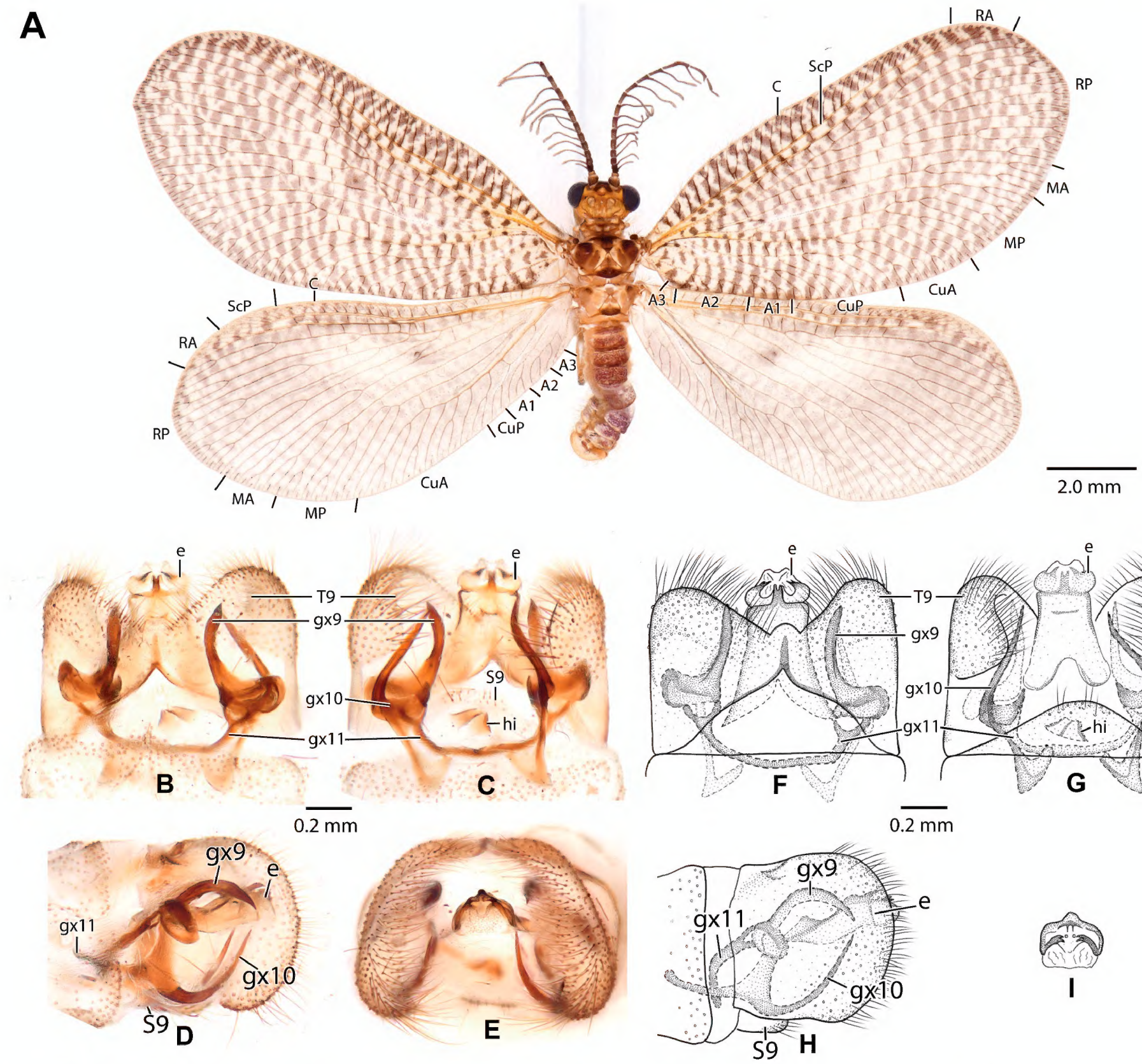

Figure 3. *Dilar lanlingensis* sp. nov., male holotype. **A.** Habitus photo; **B–E.** Genitalia, photographs: **B.** Dorsal view; **C.** Ventral view; **D.** Lateral view; **E.** Caudal view; **F–I.** Genitalia, line drawings: **F.** Dorsal view; **G.** Ventral view; **H.** Lateral view; **I.** Ectoproct, caudal view. Abbreviations: e: ectoproct; gx9: gonocoxite 9; gx10: gonocoxite 10; gx11: fused gonocoxites 11; hi: hypandrium internum; S9: sternum 9; T9: tergum 9. Scale bars: (**A**) 2.0 mm; (**B–E**) 0.2 mm; (**F–I**) 0.2 mm.

Distribution. China (Jiangsu).

Remarks. The new species belongs to the *D. hastatus* species-group by the male gonocoxite 9 generally with inflated proximal half and unguiform or bifid tip, the slender elongate male gonocoxite 10, which is generally much longer than gonocoxite 9 and by the slender beam-shaped male fused gonocoxites 11, which is generally expanded on both ends.

Concerning the species of the *D. hastatus* species-group, the new species appears to be closely related to the species distributed in East Asia, such as *D. japonicus* McLachlan, 1883, *D. septentrionalis*, *D. taiwanensis* and *D. tianmuanus*, in having similar male genital characters, for example, the presence of posterodorsal digitiform projection of male ectoproct, the male gonocoxite 9 with spoon-shaped proximal half and the male fused gonocoxites 11 generally laterally bifurcated at the end. However, *D. lanlingensis* sp. nov. can be distinguished from the other species by the distinctly bifid, posterodorsal digitiform projection of the ectoproct (Fig. 3B, F) and the male gonocoxite 9 directed posteroventrally, not incurved in dorsal view (Fig. 3B, F). In the other East Asian species of the *D. hastatus* species-group, the digitiform posterodorsal projection of the male ectoproct is serrated or convex, not distinctly bifurcated and the male gonocoxite 9 is generally strongly incurved in dorsal view (Zhang et al. 2014c, 2015).

Dilar lulanae sp. nov.

https://zoobank.org/DB57DC45-57ED-4EBC-B7DC-72799B73C2BB

Fig. 4

Common name. 路兰栉角蛉

Diagnosis. The new species is characterised by the forewing with densely transverse arcuate stripes (Fig. 4A, B), by the presence of male dorsoprocessus (Fig. 4C, I), by

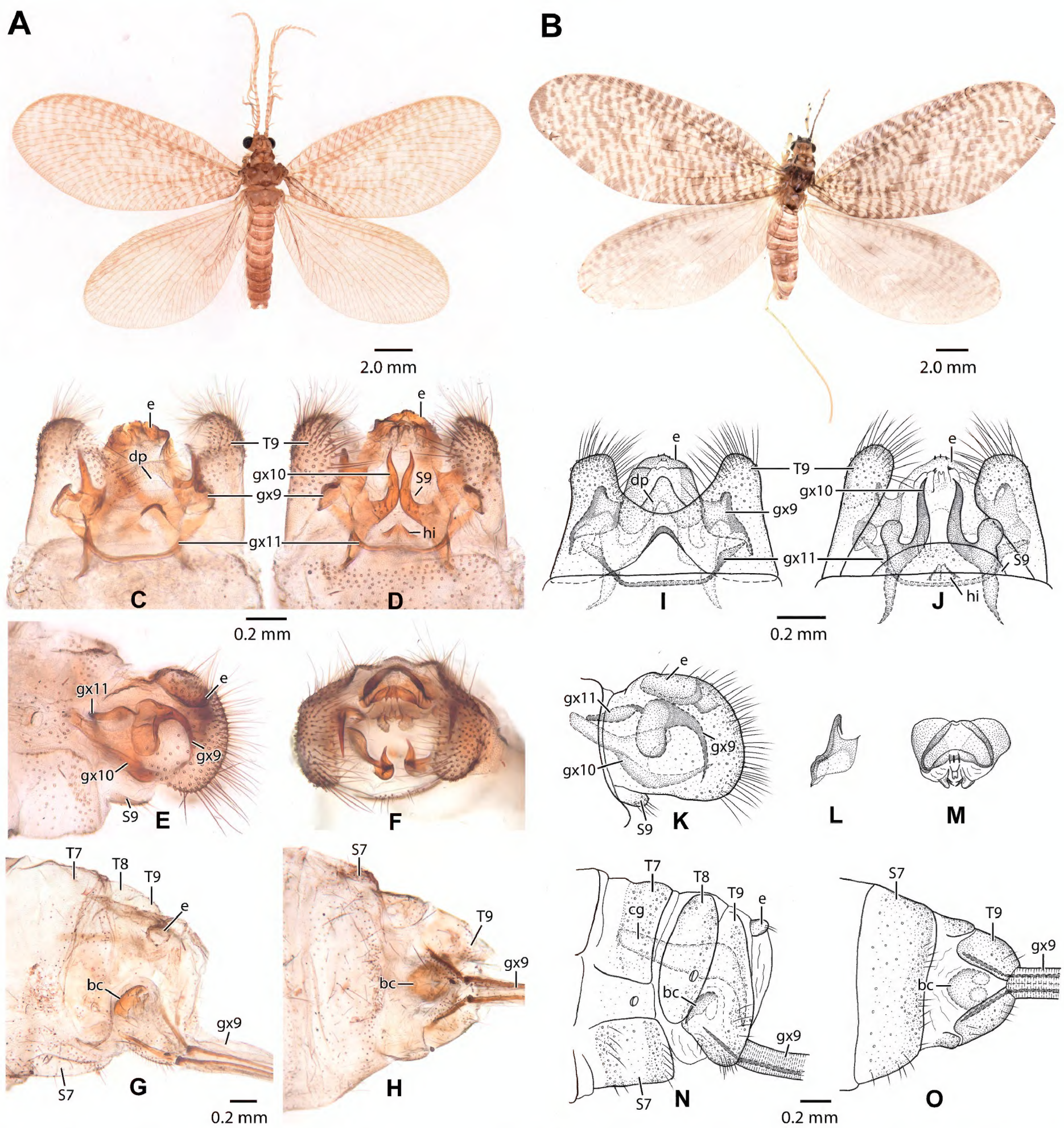

Figure 4. *Dilar lulanae* sp. nov. **A.** Male holotype, habitus photo; **B.** Female paratype, habitus photo; **C–F.** Male genitalia, photographs: **C.** Dorsal view; **D.** Ventral view; **E.** Lateral view; **F.** Caudal view; **G–H.** Female genitalia, photographs: **G.** Lateral view; **H.** Ventral view; **I–M.** Male genitalia, line drawings: **I.** Dorsal view; **J.** Ventral view; **K.** Lateral view; **L.** Gonocoxite 9, dorsal view; **M.** Ectoproct, caudal view; **N–O.** Female genitalia, line drawings: **N.** Lateral view; **O.** Ventral view. Abbreviations: bc: bursa copulatrix; cg: colleterial gland; dp: dorsoprocessus; e: ectoproct; gx9: gonocoxite 9; gx10: gonocoxite 10; gx11: fused gonocoxites 11; hi: hypandrium internum; S7–9: sternum 7–9; T7–9: tergum 7–9. Scale bars: (**A**) 2.0 mm; (**B**) 2.0 mm; (**C–F**) 0.2 mm; (**G, H**) 0.2 mm; (**I–M**) 0.2 mm; (**N–O**) 0.2 mm.

the male ectoproct posterodorsally with three sclerotised, tiny teeth at the middle (Fig. 4C, I) and by the male gonocoxite 9 proximately with a rounded lobe curved ventrally and distally, with a pointed lateral projection and an elongate spinous medial projection (Fig. 4C, I, L).

Description. Male. Body length 9.2 mm; forewing length 11.8 mm, hindwing length 10.2 mm.

Head generally brown, with brown setose tubercles, tubercles surrounded by dark brown markings; vertex pale brown. Compound eyes blackish-brown. Antenna pale brown, scapus darker, each flagellum darker distally; flagellum pectinate, medial branches longer than those branches at base, longest branch nearly 6.2 times as long as corresponding flagellomere, distal six flagellomeres simple.

Thorax brown; pronotum with a pair of pale brown ovoid tubercles at middle, tubercles surrounded by dark brown markings; mesonotum darker at middle, as well as along anterior, posterior and lateral margins; metanotum

much paler than mesonotum, with posterior margin slightly darker. Legs yellow, femora, tibiae and each tarsomere dark brown at tip. Wings pale brown (Fig. 4A). Forewing 2.3 times as long as wide, with many transversely arcuate stripes, markings darker on base and costal space; two nygmata present at base and middle, median nygma surrounded by a brown spot; longitudinal veins pale yellow, interrupted by many brown spots; crossveins pale brown. Hindwing 2.1 times as long as wide, almost entirely pale brown, with less markings than forewing.

Abdomen brown, each pregenital segment dorsally dark brown. Tergum 9 in dorsal view with an arcuate incision, a nearly U-shaped posterior incision and a dorsoprocessus, leaving a pair of hemitergites, which are obtuse distally and densely setose; dorsoprocessus subtriangular, almost membranous (Fig. 4C, I). Sternum 9 nearly subtrapezoidal, only one third in length of tergum 9, convex posteriad (Fig. 4J, K). Ectoproct in dorsal view nearly trapezoidal, with an arcuate anterior incision; posterodorsally with three sclerotised, tiny teeth at middle (Fig. 4C, I), posteroventrally with a bifid digitiform projection and a pair of bifid unguiform projections (Fig. 4I, M). Gonocoxite 9 nearly trapezoidal in dorsal view, anteriorly with a rounded lobe strongly curved ventrally along lateral margin, posteriorly with a pointed lateral projection and an elongate, spinous medial projection curved ventrally (Fig. 4C, I, L). Gonocoxite 10 slender elongate, almost twice as long as gonocoxite 9, anterior half weakly sclerotised, with pointed base, medially swollen and rounded, distally strongly sclerotised, with a blade-like projection (Fig. 4D, J). Fused gonocoxites 11 nearly beam-shaped, laterally slightly extended, connecting to bases of gonocoxite 9 (Fig. 4C, I). Hypandrium internum nearly trapezoidal, with lateral margins slightly arcuate (Fig. 4D, J).

Female. Body length 11.0 mm; forewing length 16.6 mm, hindwing length 14.0 mm.

Wings with markings much darker than those in male (Fig. 4B).

Sternum 7 in lateral view nearly rectangular, in ventral view nearly trapezoidal, with posterior margin slightly concave at middle. Segment 8 ventrally without subgenitale (Fig. 4H, O). Tergum 9 in lateral view as wide as tergum 8 (Fig. 4G, N). Bursa copulatrix with colleterial gland tubular, extended to segment 7; basal part of bursa copulatrix like a round sac, in lateral view anteriorly strongly sclerotised (Fig. 4G, N), in ventral view like a rounded sclerite posteriorly with a pair of smaller, ovoid projections (Fig. 4H, O); bursal accessory gland not observed. Ectoproct small, ovoid (Fig. 4G, N).

Materials examined. ***Holotype*** ♂, China • Chongqing Province, Guangyangwulipo Nature Reserve [官阳五里坡自然保护区], 31.3733°N, 109.9289°E, 1834 m alt., 22–23.VI.2021, Lulan Jie (CAU). ***Paratypes*** • 1♀9♂, same data as holotype (CAU).

Etymology. The species is dedicated to Ms. Lulan Jie, who is a friend of the first author and collected the type specimens.

Distribution. China (Chongqing).

Remarks. This is the first record of the species from Chongqing Province in China. The new species *D. lulanae* sp. nov. is possibly a member of the *D. guangxiensis* species-group based on the presence of the dorsoprocessus of male tergum 9 (Fig. 4C, I). However, in the *D. guangxiensis* species-group, the male gonocoxite 10 generally protrudeg a pointy lobe connecting to gonocoxite 9 submedially (Zhang et al. 2015). In *D. lulanae* sp. nov., the male gonocoxite 10 is swollen and rounded medially (Fig. 4D, J). Furthermore, the new species can be distinguished from other members of the *D. guangxiensis* species-group by the short male gonocoxite 9, which is only half length of gonocoxite 10 (Fig. 4D, J). In all the other members of the *D. guangxiensis* species-group, the male gonocoxite 9 is much longer or almost same length of gonocoxite 10 (Zhang et al. 2015).

Dilar puerensis sp. nov.

https://zoobank.org/7B51E55C-9CA4-4802-8202-249976F1CBB9

Fig. 5

Common name. 普洱栉角蛉

Diagnosis. The new species is characterised by the forewing with many brown stripes (Fig. 5A) and by the bifurcated male gonocoxite 10, with a spinous mesal lobe directed medially and a falcate lateral lobe directed laterally (Fig. 5C, G).

Description. Male. Body length 5.6 mm; forewing length 8.2 mm, hindwing length 7.0 mm.

Head generally brown, with pale brown setose tubercles; vertex brown. Compound eyes blackish-brown. Antenna generally brown, but scapus and pedicellus dark brown; flagellum pectinate, medial branches longer than those branches at base, longest branch nearly 3.5 times as long as corresponding flagellomere, distal seven flagellomeres simple.

Thorax brown; pronotum with a pair of yellow ovoid tubercles at middle; mesonotum dark brown at middle, as well as along anterior, posterior and lateral margins; metanotum much paler than mesonotum. Legs pale brown, tibiae and each tarsomere dark brown at tip. Wings hyaline, slightly pale brown (Fig. 5A). Forewing 2.3 times as long as wide, with many transversely arcuate stripes, a small immaculate area present distad median nygma, markings darker on base; two nygmata present at base and middle, nygmata respectively surrounded by small brownish spot; longitudinal veins pale yellow, interrupted by many brown spots; crossveins pale brown. Hindwing 2.2 times as long as wide, almost immaculate.

Abdomen brown, with each pregenital segment dark brown dorsally. Tergum 9 in dorsal view with an arcuate incision, a nearly V-shaped posterior incision, leaving a pair of triangular hemitergites, which are obtuse distally and densely setose. Sternum 9 almost half as long as tergum 9, convex posteriad (Fig. 5G, H). Ectoproct in dorsal view nearly rectangular, with a deeply anterior incision; posterodorsally arcuately concaved medially, laterally with a short digitiform and a unguiform projections (Fig. 5B, F); posteroventrally with a bifid digitiform projection and

Figure 5. *Dilar puerensis* sp. nov., male holotype. **A.** Habitus photo; **B–E.** Genitalia, photographs: **B.** Dorsal view; **C.** Ventral view; **D.** Lateral view; **E.** Caudal view; **F–I.** Genitalia, line drawings: **F.** Dorsal view; **G.** Ventral view; **H.** Lateral view; **I.** Ectoproct, caudal view. Abbreviations: e: ectoproct; gx9: gonocoxite 9; gx10: gonocoxite 10; gx11: fused gonocoxites 11; hi: hypandrium internum; S9: sternum 9; T9: tergum 9. Scale bars: (**A**) 2.0 mm; (**B–E**) 0.2 mm; (**F–I**) 0.2 mm.

a pair of bifid unguiform projections (Fig. 5E, I). Gonocoxite 9 slender elongated, proximal 1/3 inflated, nearly rectangular, distal 2/3 slender elongated, blade-like, with laterally directed tip (Fig. 5B, F). Gonocoxite 10 almost as long as gonocoxite 9, submedially with a sclerite connecting to gonocoxite 9, medially bifurcate, with a spinous mesal lobe directed medially and a falcate lateral lobe directed laterally (Fig. 5C, G). Fused gonocoxites 11 nearly beam-shaped, laterally connecting to bases of gonocoxites 9 (Fig. 5B, F). Hypandrium internum nearly trapezoidal, with lateral margins slightly arcuate (Fig. 5B, F).

Materials examined. ***Holotype*** ♂, China • Yunnan Province, Puer, Dachunhe [普洱大椿河], 1400 m alt., 22.V.2021, Yuchen Zheng (CAU). ***Paratypes*** • 16 ♂, same data as holotype (CAU).

Etymology. The specific epithet "*puerensis*" refers to the type locality of the new species, i.e. Puer City, Yunnan Province, China.

Distribution. China (Yunnan).

Remarks. The new species should be a member of the *D. lijiangensis* species-group, based on the slender elongate male gonocoxite 9, which is inflated at base and the male gonocoxite 10 submedially bifurcated. Amongst the species of the *D. lijiangensis* species-group, the new species appears to be closely related to *D. nobilis* from Yunan, China, in having similar characters, for example, the forewing with many dark spots connected with each other, the male ectoproct posterodorsally with two pairs of lateral projections, the slender elongate male gonocoxite 9 inflated at base and the slender elongate male gonocoxite 10 bifurcated at the middle. However, the new species can be clearly distinguished from the latter species by the male gonocoxite 9 not strongly incurved in dorsal view (Fig. 5B, F), the bifid male gonocoxite 10 with slightly longer, straight inner lobe and relatively shorter, falcate outer lobe (Fig. 5C, G). In *D. nobilis*, the male gonocoxite 9 is strongly incurved in

dorsal view and the bifid male gonocoxite 10 has a shorter, laterally curved inner lobe and relatively longer, digitiform outer lobe (Zhang et al. 2015: fig. 83).

Dilar qiongduensis sp. nov.

https://zoobank.org/1C5A88AE-1866-443B-A418-42786A835A59

Fig. 6

Common name. 邛都栉角蛉

Diagnosis. The new species is characterised by the forewing with many short, arcuate stripes throughout (Fig. 6A), by male gonocoxite 9 notably inflated, with rectangular proximal half (Fig. 6B, F), by the blade-like male gonocoxite 10 submedially with a sclerite connecting to gonocoxite 9 (Fig. 6G) and by the W-shaped male fused gonocoxites 11 (Fig. 6C, F).

Description. Male. Body length 8.4 mm; forewing length 10.2 mm, hindwing length 9.2 mm.

Head generally brown, with pale yellow setose tubercles; vertex brown. Compound eyes blackish-brown. Antenna brown, scapus and pedicellus dark brown; flagellum pectinate, medial branches longer than those branches at base, longest branch nearly 5.2 times as long as corresponding flagellomere, distal seven flagellomeres simple.

Thorax brown; pronotum paler, with a pair of yellow ovoid tubercles at middle; mesonotum dark brown at middle, as well as along anterior, posterior and lateral margins, submedially with a pair of brown oblique markings; metanotum paler than mesonotum. Legs pale brown, tibiae and each tarsomere dark brown at tip. Wings slightly pale brown (Fig. 6A). Forewing 2.4 times as long as wide, with many transversely arcuate stripes, markings darker on the proximal 1/3 and costal

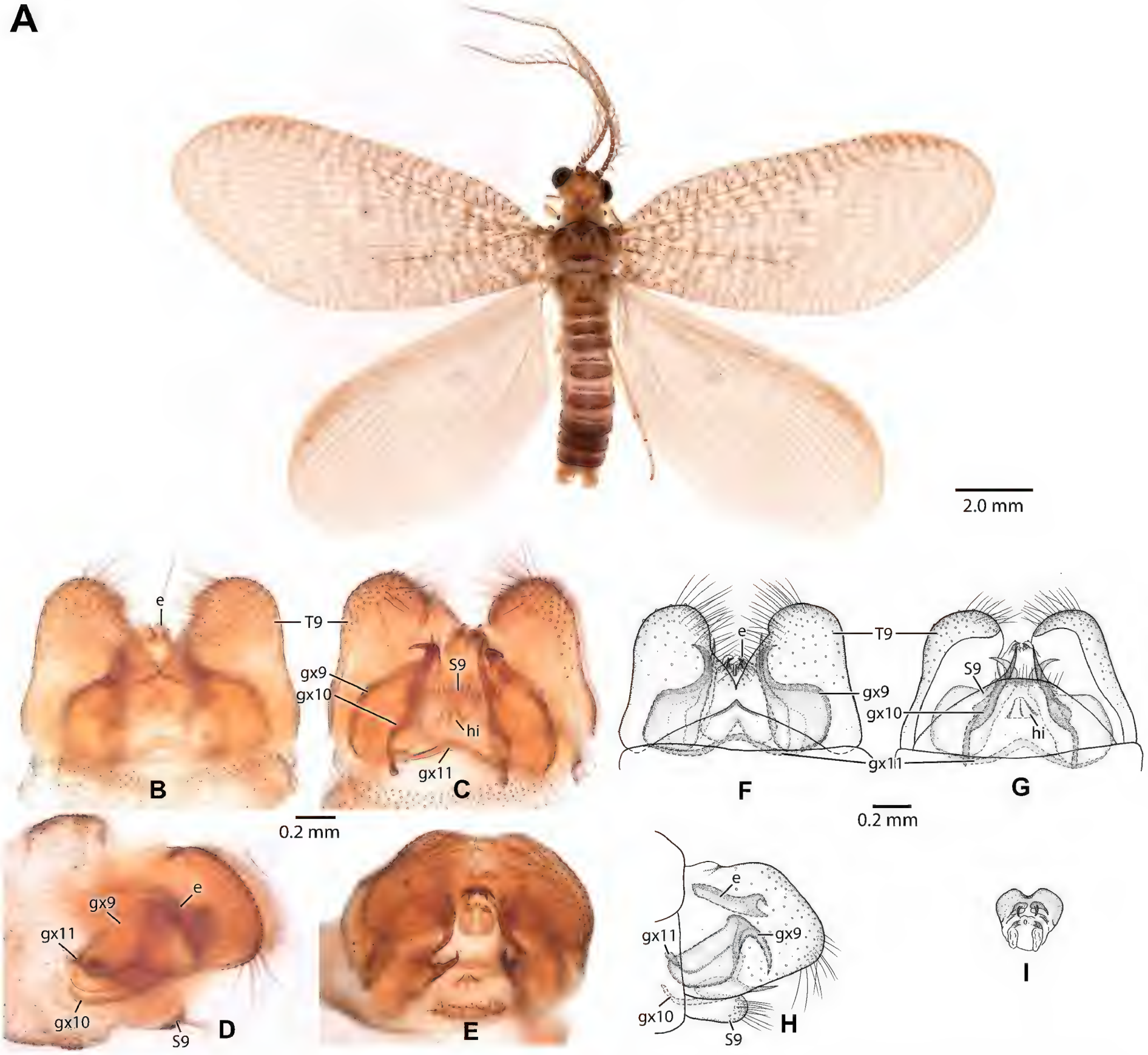

Figure 6. *Dilar qiongduensis* sp. nov., male holotype. **A.** Habitus photo; **B–E.** Genitalia, photographs: **B.** Dorsal view; **C.** Ventral view; **D.** Lateral view; **E.** Caudal view; **F–I.** Genitalia, line drawings: **F.** Dorsal view; **G.** Ventral view; **H.** Lateral view; **I.** Ectoproct, caudal view. Abbreviations: e: ectoproct; gx9: gonocoxite 9; gx10: gonocoxite 10; gx11: fused gonocoxites 11; hi: hypandrium internum; S9: sternum 9; T9: tergum 9. Scale bars: (**A**) 2.0 mm; (**B–E**) 0.2 mm; (**F–I**) 0.2 mm.

space; two nygmata respectively present at base and middle, median nygma surrounded by a small brownish spot; longitudinal veins pale yellow, interrupted by many brown spots; crossveins pale brown. Hindwing 2.3 times as long as wide, almost immaculate.

Abdomen brown, with each pregenital segment dark brown dorsally. Tergum 9 in dorsal view with an arcuate incision, a nearly V-shaped posterior incision, leaving a pair of hemitergites, which are obtuse distally and densely setose. Sternum 9 subtrapezoidal, almost half as long as tergum 9, truncate posteriad (Fig. 6C, G). Ectoproct in dorsal view nearly rectangular, with an anterior incision; posterodorsally with a pair of unguiform projections (Fig. 6F, I), posteroventrally with a digitiform projection and a pair of bifid unguiform projections (Fig. 6I). Gonocoxite 9 inflated at proximal half, nearly rectangular, distal half tapering and curved posterolaterally (Fig. 6B, F). Gonocoxite 10 almost as long as gonocoxite 9, blade-like, with straight and obtuse base, submedially with a sclerite connecting to gonocoxite 9 (Fig. 6C, G). Fused gonocoxites 11 nearly W-shaped, laterally connecting to bases of gonocoxites 9 (Fig. 6C, F). Hypandrium internum nearly trapezoidal, with lateral margins slightly arcuate (Fig. 6C, G).

Materials examined. ***Holotype*** ♂, China • Sichuan Province, Xichang, Dajinglinchang [西昌市大箐林场], 16.V.2020, Tao Li (CAU). ***Paratypes*** • 34 ♂, same data as holotype (CAU).

Etymology. The specific epithet "*qiongduensis*" is derived from "Qiongdu [邛都]," the ancient name for the south-eastern region of present-day Xichang City, Sichuan, China, where the type specimen was collected. Historically, Qiongdu was an important administrative and cultural centre as early as the Western Han Dynasty, when it served as the capital of Qiongdu County. Situated along the ancient trade routes of southwestern China, it played a key role in the development of the region, particularly as part of the Southern Silk Road. The name Qiongdu reflects the area's historical significance as a hub of cultural exchange, economic activity and strategic importance in the Sichuan Basin. The use of this name honours both the cultural heritage and the natural richness of the region where the species was discovered.

Distribution. China (Sichuan).

Remarks. The new species should be a member of the *D. spectabilis* species-group, based on the male ectoproct posterodorsally generally with a pair of curved unguiform projections and by the slender elongate male gonocoxite 10 which submedially has a subtriangular lobe connecting to gonocoxite 9, but it can be distinguished from all the other members by the male gonocoxite 9 notably inflated, with rectangular proximal half (Fig. 6B, F), the male gonocoxite 10 with straight base (Fig. 6C, G) and the W-shaped fused male gonocoxites 11 (Fig. 6C, F). In other members of the *D. spectabilis* species-group, the base half of male gonocoxite 9 is generally subtriangular shape and the fused male gonocoxites 11 are anteriorly convex, not W-shaped (Zhang et al. 2015).

Dilar tuyuezhengi sp. nov.

https://zoobank.org/522E461E-E335-4863-89AE-A2BCF3248DE4

Fig. 7

Common name. 涂粤峥栉角蛉

Diagnosis. The new species is characterised by the forewing intensively spotted, with marginal markings largely continuous which are covering along the edge of the whole forewing (Fig. 7A, B), by bifurcated male gonocoxite 9, with a spinous inner projection and a relatively longer, unguiform outer projection (Fig. 7D, I) and by the slender elongate male gonocoxite 10 submedially expanding laterally and forming a narrow rectangular lobe (Fig. 7D, J).

Description. Male. Body length 5.4 mm; forewing length 7.2 mm, hindwing length 6.4 mm.

Head generally brown, with dark brown setose tubercles; vertex pale brown. Compound eyes blackish-brown. Antenna generally brown, flagellum pale brown, with distal margin of each flagellomere distinctly dark; flagellum pectinate, medial branches longer than those branches at base, longest branch nearly 4.0 times as long as corresponding flagellomere, distal six flagellomeres simple.

Thorax dark brown; pronotum with a pair of yellow ovoid tubercles at middle; mesonotum dark brown at middle, as well as along anterior and lateral margins, submedially with a pair of yellowish semi-lunar-like markings; metanotum much paler than mesonotum. Legs pale brown, femora, tibiae and each tarsomere dark brown at tip. Wings smoky brown (Fig. 7A). Forewing 2.3 times as long as wide, with many brown transverse stripes across entire wing which are notably darker on base and subcostal region; marginal markings largely continuous, forming a band that runs along the edge of the whole forewing; three and two nygmata, respectively present on left and right forewing, at base and middle, nygmata respectively surrounded by a pale brown spot; longitudinal veins pale yellow, interrupted by many brown spots; crossveins pale brown. Hindwing 2.2 times as long as wide, almost immaculate.

Abdomen brown. Tergum 9 in dorsal view with a deeply posterior incision, leaving a pair of hemitergites, which are obtuse distally and densely setose; the posteromedian region of tergum 9 slightly convex. Sternum 9 subtriangular, only one third in length of tergum 9, almost convex posteriad (Fig. 7D, J). Ectoproct in dorsal view nearly trapezoidal, anteriorly with an arcuate incision; posterodorsally with an abrupt incision, a pair of obtuse projections and a pair of slender elongate spine-like projections (Fig. 7C, I); posteroventrally with a pair of a pair of bifid unguiform projections laterally and a pair of digitiform projections at the middle (Fig. 7J, L). Gonocoxite 9 slightly flattened on proximal half, lateral margin expanding ventrally, distal half bifurcated, with one relatively shorter, spinous inner projection directed posteriorly and one slightly longer, unguiform outer projection directed posteroventrally (Fig. 7C, I). Gonocoxite 10 slender elongate, almost twice as long as gonocoxite 9, with hook-like base and spinous tip, submedially with lateral margin slightly expanding dorsolaterally and

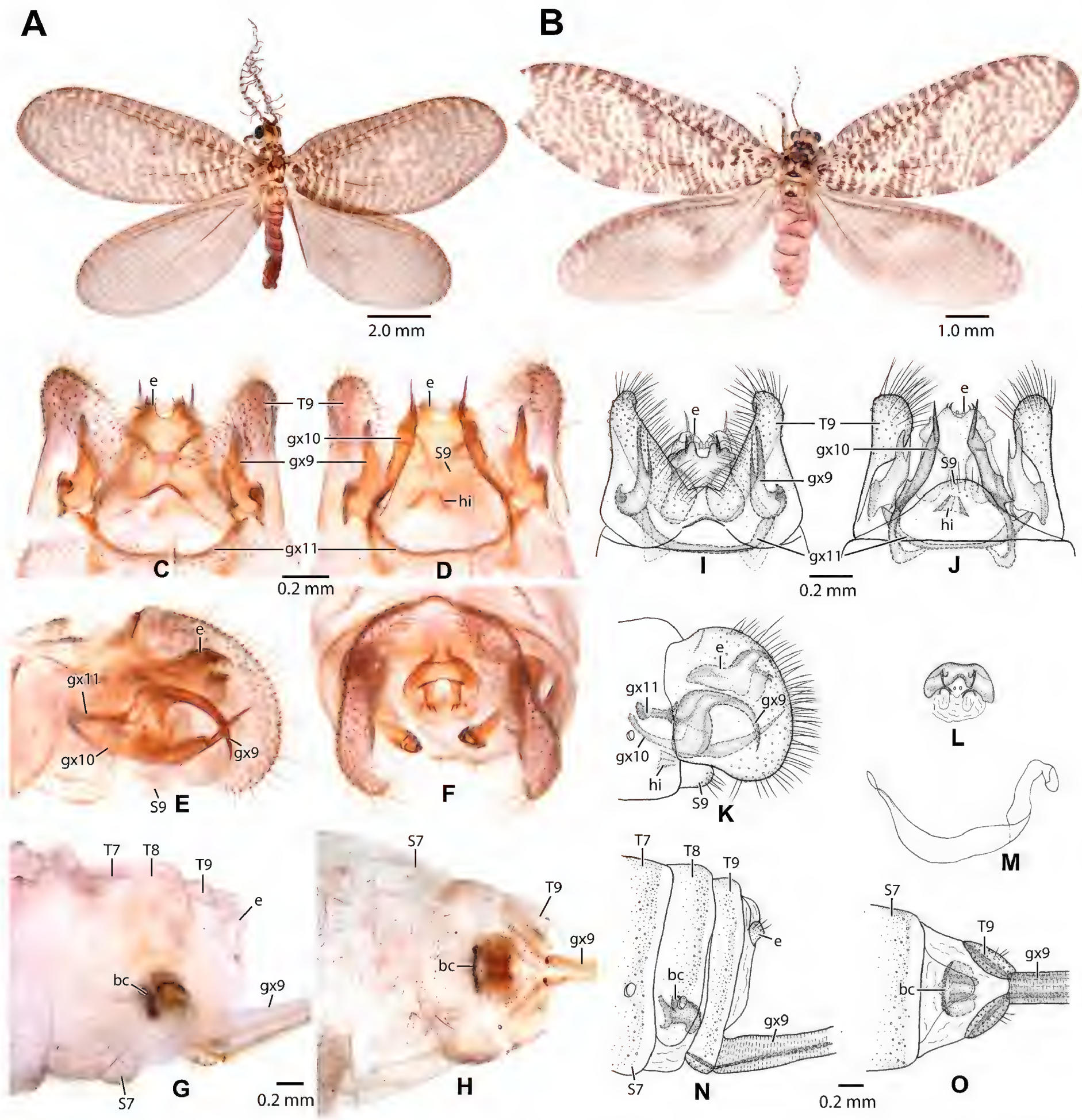

Figure 7. *Dilar tuyuezhengi* sp. nov. **A.** Male holotype, habitus photo; **B.** Female paratype, habitus photo; **C–F.** Male genitalia, photographs: **C.** Dorsal view; **D.** Ventral view; **E.** Lateral view; **F.** Caudal view; **G, H.** Female genitalia, photographs: **G.** Lateral view; **H.** Ventral view; **I–L.** Male genitalia, line drawings: **I.** Dorsal view; **J.** Ventral view; **K.** Lateral view; **L.** Ectoproct, caudal view; **M–O.** Female genitalia, line drawings: **M.** Colleterial gland, lateral view; **N.** Lateral view; **O.** Ventral view. Abbreviations: bc: bursa copulatrix; e: ectoproct; gx9: gonocoxite 9; gx10: gonocoxite 10; gx11: fused gonocoxites 11; hi: hypandrium internum; S7–9: sternum 7–9; T7–9: tergum 7–9. Scale bars: (**A**) 2.0 mm; (**B**) 2.0 mm; (**C–F**) 0.2 mm; (**G, H**) 0.2 mm; (**I–M**) 0.2 mm; (**N, O**) 0.2 mm.

forming a narrow rectangular lobe (Fig. 7D, J). Fused gonocoxites 11 nearly beam-shaped, anteriorly convex, laterally slightly expanded, connecting to bases of gonocoxites 9 (Fig. 7C, I). Hypandrium internum nearly trapezoidal, with lateral margins slightly arcuate (Fig. 7D, J).

Female. Body length 6.5 mm; forewing length 11.2 mm, hindwing length 9.2 mm.

Wings with markings slightly darker, but seemingly not as dense as those in male, a relatively immaculate area distad to the median nygma (Fig. 7B).

Sternum 7 in lateral view nearly rectangular, in ventral view nearly rectangular, with posterior margin almost truncate. Segment 8 ventrally with a subtriangular, membranous structure, which is convex posteriorly, putative as subgenitale (Fig. 7O). Tergum 9 in lateral view as wide as tergum 8 (Fig. 7G, N). Bursa copulatrix with colleterial gland tubular, extended to segment 7. Bursa copulatrix in lateral view present as two tightly-connected parts, with the anterior one as a curved lobe and the posterior one broadly sac-like, distally curved ventrally (Fig. 7G, N)

and in ventral view, present as an anteriorly strongly-sclerotised ovoid plate, medially bearing a pair of digitiform projections (Fig. 7H, O). Bursal accessory gland not observed. Ectoproct small, ovoid (Fig. 7G, N).

Materials examined. ***Holotype*** ♂, China • Yunnan Province, Yiliang, Xiaocaoba Reserve [彝良县小草坝保护区], 1800–2000 m alt., 20.VII.2023, Yuezheng Tu (CAU). ***Paratype*** • 1♀, same data as holotype (CAU).

Etymology. The species is dedicated to Mr. Yuezheng Tu, who is a friend of the first author and collected the type specimens.

Distribution. China (Yunnan).

Remarks. The new species should be a member of the *D. hastatus* species-group, based on the male gonocoxite 9 generally with inflated proximal half and bifid tip, the slender elongate male gonocoxite 10, which is generally much longer than gonocoxite 9 and by the slender beam-shaped male fused gonocoxites 11, which is generally expanded on both ends. Amongst all known species of the *D. hastatus* species-group, the new species resembles *D. bifurcatus*, in having similar external appearance and male genital characters, such as the forewing intensively spotted with continuous marginal markings, the male gonocoxite 9 bifurcated on distal half, the slender elongate male gonocoxite 10 with hook-like base. However, the new species can be distinguished from the latter by the male ectoproct posterodorsally with a pair of obtuse projections and a pair of spine-like projections (Fig. 7C, I, L) and the male gonocoxite 10 submedially with lateral margin slightly expanding, forming a narrow rectangular lobe (Fig. 7D, J). In *D. bifurcatus*, the male ectoproct posterodorsally has no projections and the male gonocoxite 10 are not expanded along lateral margin (Zhang et al. 2015: fig. 21).

Dilar weiningensis sp. nov.

https://zoobank.org/7AB7ACCF-714D-4C8E-B679-26215CC49E09

Fig. 8

Common name. 威宁栉角蛉

Diagnosis. The new species is characterised by the forewing with many brown spots connected with each other as discontinuous stripes (Fig. 8A) and by the inflated male gonocoxite 10 subdistally forming an additional blade-like lobe (Fig. 8C, G).

Description. Male. Body length 5.0 mm; forewing length 9.2 mm, hindwing length 7.4 mm.

Head generally brown, with pale brown setose tubercles; vertex brown. Compound eyes blackish-brown. Antenna brown, scapus slightly darker, but pedicellus paler and pedicellus dark brown; flagellum pectinate, medial branches longer than those branches at base, longest branch nearly 5.0 times as long as corresponding flagellomere, distal several flagellomeres damaged.

Thorax brown; pronotum with a pair of yellow ovoid tubercles at middle; mesonotum dark brown on mesoscutellum, as well as along anterior and lateral margins; metanotum paler than mesonotum. Legs pale brown, tibiae and each tarsomere dark brown at tip. Wings slightly pale brown (Fig. 8A). Forewing 2.2 times as long as wide, brown spots, which are mostly connected with each other and arranged as discontinuous stripes; markings darker on base and costal space; two nygmata respectively present at base and middle, median nygma surrounded by a small brownish spot; longitudinal veins pale yellow, interrupted by many brown spots; crossveins pale brown. Hindwing 2.2 times as long as wide, almost immaculate.

Abdomen brown. Tergum 9 in dorsal view with an arcuate incision, a nearly U-shaped posterior incision, leaving a pair of hemitergites, which are obtuse distally and densely setose. Sternum 9 almost half as long as tergum 9, convex posteriad (Fig. 8C, G). Ectoproct in dorsal view nearly trapezoidal, with an arcuately anterior incision; posterodorsally with a pair of unguiform projections (Fig. 8B, F), posteroventrally with a pair of digitiform projections and a pair of unguiform projections (Fig. 8C, G, I). Gonocoxite 9 inflated at middle, with small and obtuse base, distal 1/3 bifurcated, with an incurved, unguiform projection and a shorter, pointed projection directed posterolaterally (Fig. 8B, F). Gonocoxite 10 slightly inflated, almost as long as gonocoxite 9, with narrow, incurved base, subdistally forming an additional blade-like lobe (Fig. 8C, G). Fused gonocoxites 11 nearly beam-shaped, strongly anteriorly convex, laterally connecting to bases of gonocoxites 9 (Fig. 8C, F). Hypandrium internum large, nearly trapezoidal, with lateral margins slightly arcuate (Fig. 8C, G).

Materials examined. ***Holotype*** ♂, China • Guizhou Province, Weining County, Zhejue Town, Huangshan Nature Reserve [威宁县哲觉镇黄杉保护区场], 18.VIII.2020, Tao Li (CAU).

Etymology. The specific epithet "*weiningensis*" refers to the type locality of the new species, i.e. Weining County, Guizhou Province, China.

Distribution. China (Guizhou).

Remarks. The new species cannot be assigned to any of the known species-groups characterised. It is distinctly different from the other species of *Dilar*, based on the male genital characters, the flattened male gonocoxite 9 distal 1/3 bifurcated, with an incurved, unguiform projection and a shorter, pointed projection directed posterolaterally (Fig. 8F) and the male gonocoxite 10 subdistally forming an additional blade-like lobe (Fig. 8C, G).

Dilar yangyingae sp. nov.

https://zoobank.org/704B6902-CC1D-45DB-B789-CC43EA20C655

Fig. 9

Common name. 杨英栉角蛉

Diagnosis. The new species is characterised by the forewing with dense and scattered spots throughout (Fig. 9A), by the male ectoproct posterodorsally with a pair of slender elongate projections which are almost half the length of the whole ectoproct (Fig. 9C, I), by the extremely short male gonocoxite 9, which is only as one-fifth as long as

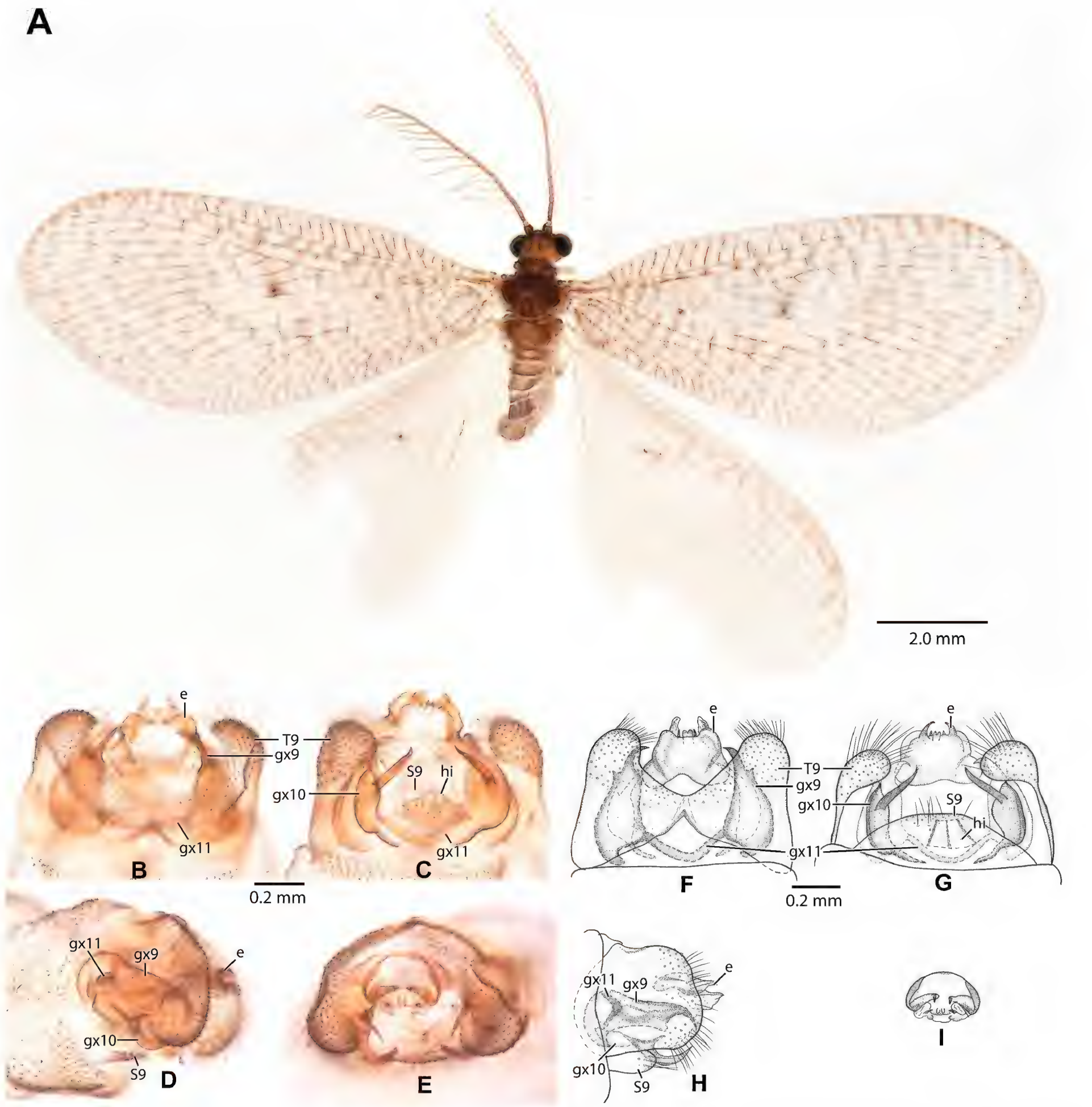

Figure 8. *Dilar weiningensis* sp. nov., male holotype. **A.** Habitus photo; **B–E.** Genitalia, photographs: **B.** Dorsal view; **C.** Ventral view; **D.** Lateral view; **E.** Caudal view; **F–I.** Genitalia, line drawings: **F.** Dorsal view; **G.** Ventral view; **H.** Lateral view; **I.** Ectoproct, caudal view. Abbreviations: dp: dorsoprocessus; e: ectoproct; gx9: gonocoxite 9; gx10: gonocoxite 10; gx11: fused gonocoxites 11; hi: hypandrium internum; S9: sternum 9; T9: tergum 9. Scale bars: (**A**) 2.0 mm; (**B–E**) 0.2 mm; (**F–I**) 0.2 mm.

gonocoxite 10 (Fig. 9D, I) and by the narrow, falcate male gonocoxite 10 (Fig. 9D, J).

Description. Male. Body length 6.0 mm; forewing length 9.7 mm, hindwing length 8.0 mm.

Head generally brown, with yellowish-brown setose tubercles; vertex pale brown. Compound eyes blackish-brown. Antenna brown; flagellum pectinate, medial branches longer than those branches at base, longest branch nearly 4.0 times as long as corresponding flagellomere, distal seven flagellomeres simple.

Thorax brown; pronotum with a pair of yellow ovoid tubercles at middle, tubercles surrounded by dark brown markings; mesonotum dark brown at middle, as well as along anterior and lateral margins, submedially with a pair of dark brown oblique stripes; metanotum much paler than mesonotum. Legs pale brown, femora, tibiae and each tarsomere dark brown at tip. Wings hyaline, slightly smoky brown (Fig. 9A). Forewing 2.3 times as long as wide, with dense and scattered spots throughout; markings darker on base; three and two nygmata, respectively present on left and right forewing, at base and middle, nygmata respectively surrounded by a brownish spot; longitudinal veins pale yellow, interrupted by many brown spots; crossveins pale brown. Hindwing 2.2 times as long as wide, almost immaculate.

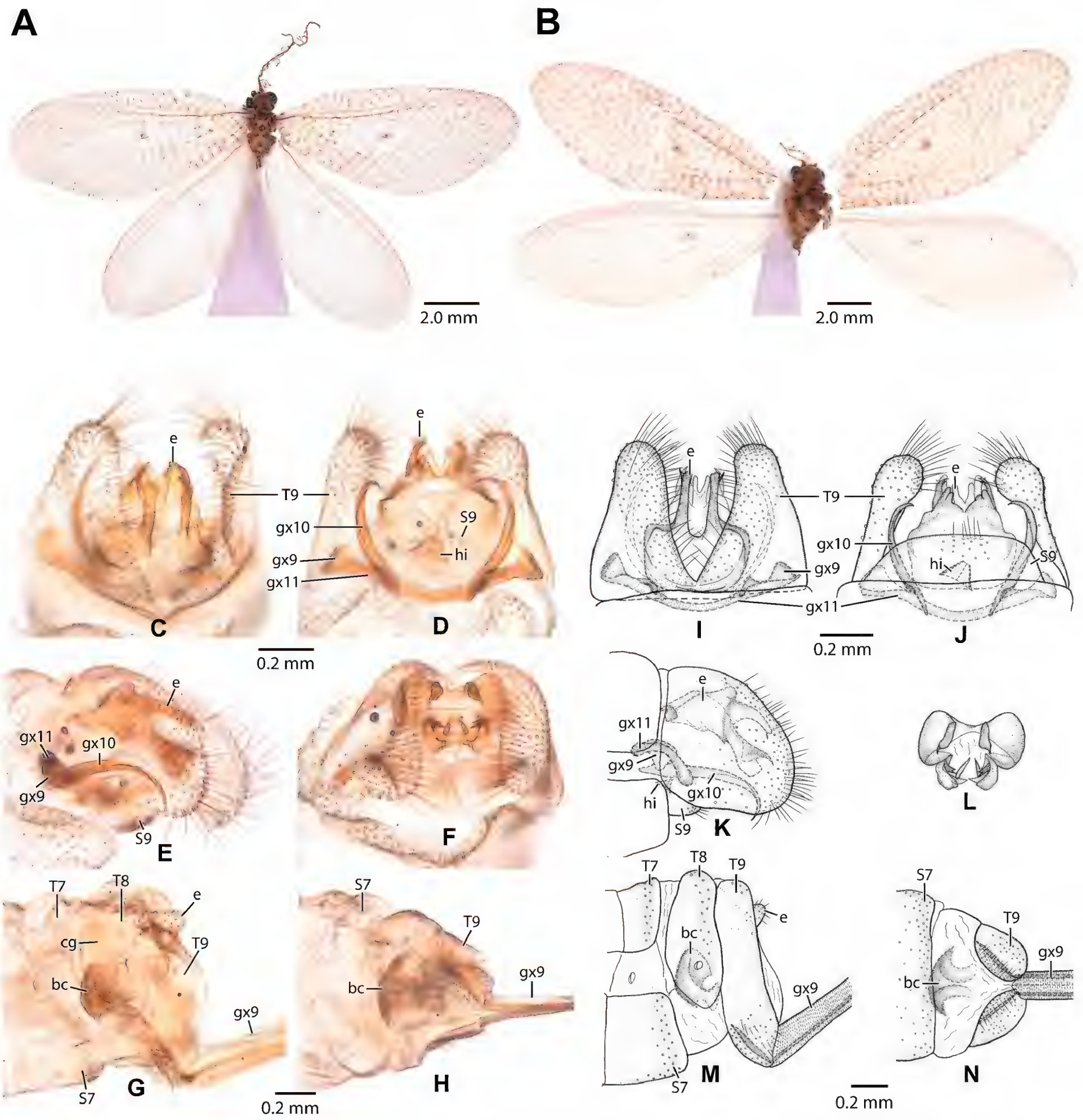

Figure 9. *Dilar yangyingae* sp. nov. **A.** Male holotype, habitus photo; **B.** Female paratype, habitus photo; **C–F.** Male genitalia, photographs: **C.** Dorsal view; **D.** Ventral view; **E.** Lateral view; **F.** Caudal view; **G, H.** Female genitalia, photographs: **G.** Lateral view; **H.** Ventral view; **I–L.** Male genitalia, line drawings: **I.** Dorsal view; **J.** Ventral view; **K.** Lateral view; **L.** Ectoproct, caudal view; **M, N.** Female genitalia, line drawings: **M.** Lateral view; **N.** Ventral view. Abbreviations: bc: bursa copulatrix; cg: colleterial gland; e: ectoproct; gx9: 9; gx10: gonocoxite 10; gx11: fused gonocoxites 11; hi: hypandrium internum; S7–9: sternum 7–9; T7–9: tergum 7–9. Scale bars: (**A**) 2.0 mm; (**B**) 2.0 mm; (**C–F**) 0.2 mm; (**G, H**) 0.2 mm; (**I–L**) 0.2 mm; (**M, N**) 0.2 mm.

Abdomen brown. Tergum 9 in dorsal view with an arcuate incision, a nearly V-shaped posterior incision, leaving a pair of hemitergites, which are obtuse distally and densely setose. Sternum 9 nearly trapezoidal, only one third in length of tergum 9, almost truncate posteriad (Fig. 9D, J). Ectoproct in dorsal view nearly rectangular, posterodorsally with a pair of slender elongate projections, almost half length of the whole ectoproct, each projection distally accompanied with a tiny lateral unguiform projection (Fig. 9C, I); posteroventrally with two pairs of digitiform projections and a pair of bifid unguiform projections (Fig. 9D, J, L). Gonocoxite 9 small, subtriangular, slightly extended transversely (Fig. 9D, I). Gonocoxite 10 slender elongate, almost five times as long as gonocoxite 9, falcate, with pointed base and tip (Fig. 9D, J). Fused gonocoxites 11 nearly beam-shaped, slightly anteriorly convex, laterally connecting to bases of gonocoxites 9 (Fig. 9D, I). Hypandrium internum nearly trapezoidal, with lateral margins slightly arcuate (Fig. 9D, J).

Female. Body length 5.0 mm; forewing length 10.0 mm, hindwing length 9.0 mm.

Wings with markings much darker than those in male (Fig. 9B).

Sternum 7 in lateral view nearly rectangular, in ventral view nearly rectangular, with posterior margin almost truncate. Segment 8 ventrally without subgenitale. Tergum 9 in lateral view as wide as tergum 8. Bursa copulatrix in lateral view irregularly sac-like, with a distinct ridge present at the upper-middle part (Fig. 9G, M) and in ventral view, as an arcuate structure bearing a pair of oppositely curved, crescent-shaped lobes (Fig. 9H, N). Colleterial gland tubular and bursal accessory gland not observed. Ectoproct small, ovoid (Fig. 9G, M).

Materials examined. ***Holotype*** ♂, China • Hubei Province, Muyu Town, Mt. Laojunshan [木鱼镇老君山], 1290 m alt., 11.VII.2021, Yangying (CAU). ***Paratype*** • 1♀, same data as holotype (CAU).

Etymology. The species is dedicated to Ms. Ying Yang, who is a friend of the first author and collected the type specimens.

Distribution. China (Hubei).

Remarks. The new species is possibly a member of the *D. hastatus* species-group, based on the slender elongate male gonocoxite 10. Compared to other species in this group, the new species appears to be related to *D. sinicus*, as they share a similar shape of the male gonocoxite 9, which is subtriangular and extremely short. However, the new species is distinguished by a unique feature of the male ectoproct, which posterodorsally bears a pair of slender, elongate digitiform projections, nearly half the length of the entire ectoproct (Fig. 9I). In contrast, the posterodorsal projections in other members of the *D. hastatus* species-group, as well as in all other species of *Dilar*, are much shorter.

Diversity distribution of *Dilar* from China

A remarkable diversity of *Dilar* occurs in China, with 49 recorded species so far, accounting for nearly half of the known global fauna of the genus. The species diversity and distribution pattern of *Dilar* and each species-group in China are summarised, based on the seven Chinese zoogeographic divisions (Figs 10, 11, Tables 1, 2). Each division is briefly described below.

North-eastern China Region (Region I)

This region harbours only one species, accounting for approximately 2% of the *Dilar* fauna in China (Fig. 10: Region I; Table 1). The only recorded species, *D. septentrionalis*, belonging to the *D. hastatus* species-group, is endemic to north-eastern China and extends to adjacent regions, including the Korean Peninsula and the Russian Far East (Li et al. 2021).

North China Region (Region II)

Four species are recorded in this region, accounting for approximately 8% of the *Dilar* fauna in China (Fig. 10: Region II; Table 1). Amongst them, *D. hastatus* is endemic to this region. The remaining three species exhibit a distinct distribution pattern along the Palaearctic-Oriental boundary, specifically the Qinling Mountains, with distribution across North China Region (II) and Central China Region (VI). Additionally, the species *D. sinicus* extends into the central area of Mongo-Xinjiang Region (III), while *D. spectabilis* shows a broader distribution with an extension into the South-western China Region (V).

Table 1. Species richness and endemism of *Dilar* Rambur, 1838 in different zoogeographic regions of China.

Region ID	Zoogeographic Region	Number of species (proportion)	Number of endemic species (proportion)	Number of species-group (proportion)
I	North-eastern China Region	1 (2.0%)	1 (100.0%)	1 (17.0%)
II	North China Region	4 (8.0%)	1 (25.0%)	2 (33.0%)
III	Mongo-Xinjiang Region	2 (4.0%)	1 (50.0%)	2 (33.0%)
IV	Qinghai-Xizang Region	3 (6.1%)	1 (33.3%)	1 (17.0%)
V	South-western China Region	17 (34.7%)	12 (70.6%)	5 (83.0%)
VI	Mid-China Region	17 (34.7%)	10 (58.8%)	3 (50.0%)
VII	South China Region	17 (34.7%)	14 (82.4%)	4 (67.0%)

Table 2. Species richness of the *Dilar* Rambur, 1838 species-group in different zoogeographic regions of China. DA = *Dilar caesarulus* species-group; DH = *Dilar hastatus* species-group; DG = *Dilar guangxiensis* species-group; DL = *Dilar lijiangensis* species-group; DS = *Dilar spectabilis* species-group; DY = *Dilar yunnanaus* species-group; NA = Not assignable to defined species-group. Percentages in bracket indicate the proportion of species in each species-group within the region relative to its total in China. Due to the unclear male specific identity, *D. subdolus* and *D. formosanus* are not included in the statistics.

Zoogeographic Region	DA	DH	DG	DL	DS	DY	NA
North-eastern China Region		1 (6%)					
North China Region		3 (19%)			1 (25%)		
Mongo-Xinjiang Region	1 (100%)	1 (6%)					
Qinghai-Xizang Region			3 (30%)				
South-western China Region		2 (13%)	5 (50%)	1 (25%)	4 (100%)	2 (67%)	4 (44%)
Mid-China Region		12 (75%)	2 (20%)		1 (25%)		
South China Region		3 (19%)	4 (40%)	3 (75%)		1 (33%)	5 (56%)

Figure 10. Distribution map of *Dilar* Rambur, 1838 in China.

Two species-groups occur in this region: the *D. spectabilis* species-group is mainly concentrated in the southwestern part, whereas the *D. hastatus* species-group is more widely distributed across the region (Fig. 11: Region II; Table 2).

Mongo-Xinjiang Region (Region III)

Only two species are recorded from this region, accounting for approximately 4% of the *Dilar* fauna in China (Fig. 10: Region III; Table 1). One of them, *D. kirgisus*, which belongs to the *D. carsarulus* species-group, indicating a strong biogeographic connection between Xinjiang and Central Asia (Fig. 11: Region III; Table 2).

Qinghai-Xizang Region (Region IV)

Three species, all belonging to the *D. guangxiensis* species-group, are recorded in this region, comprising approximately 6% of the *Dilar* fauna in China (Figs 10, 11: Region IV; Table 1). These species are restricted to southern Xizang, with some extending into north-eastern India, Bhutan and Nepal (Zhang et al. 2014b; Li et al. 2020). Two of them, i.e. *D. geometroides* and *D. tibetanus*, are mainly distributed along the boundary between this region and South-western China Region (V).

South-western China Region (Region V)

This region harbours the highest diversity of *Dilar* species and species-groups in China, with 17 recorded species across five species-groups, accounting for approximately 35% of the Chinese *Dilar* fauna (Figs 10, 11: Region V; Tables 1, 2). Amongst them, 12 species are endemic. Of the remaining five species, aside from *D. spectabilis*, which has a relatively broad distribution, the other four cross-regional species are primarily distributed near regional boundaries (Fig. 10: Region V). In terms of the distribution of the species-group, distinct patterns can

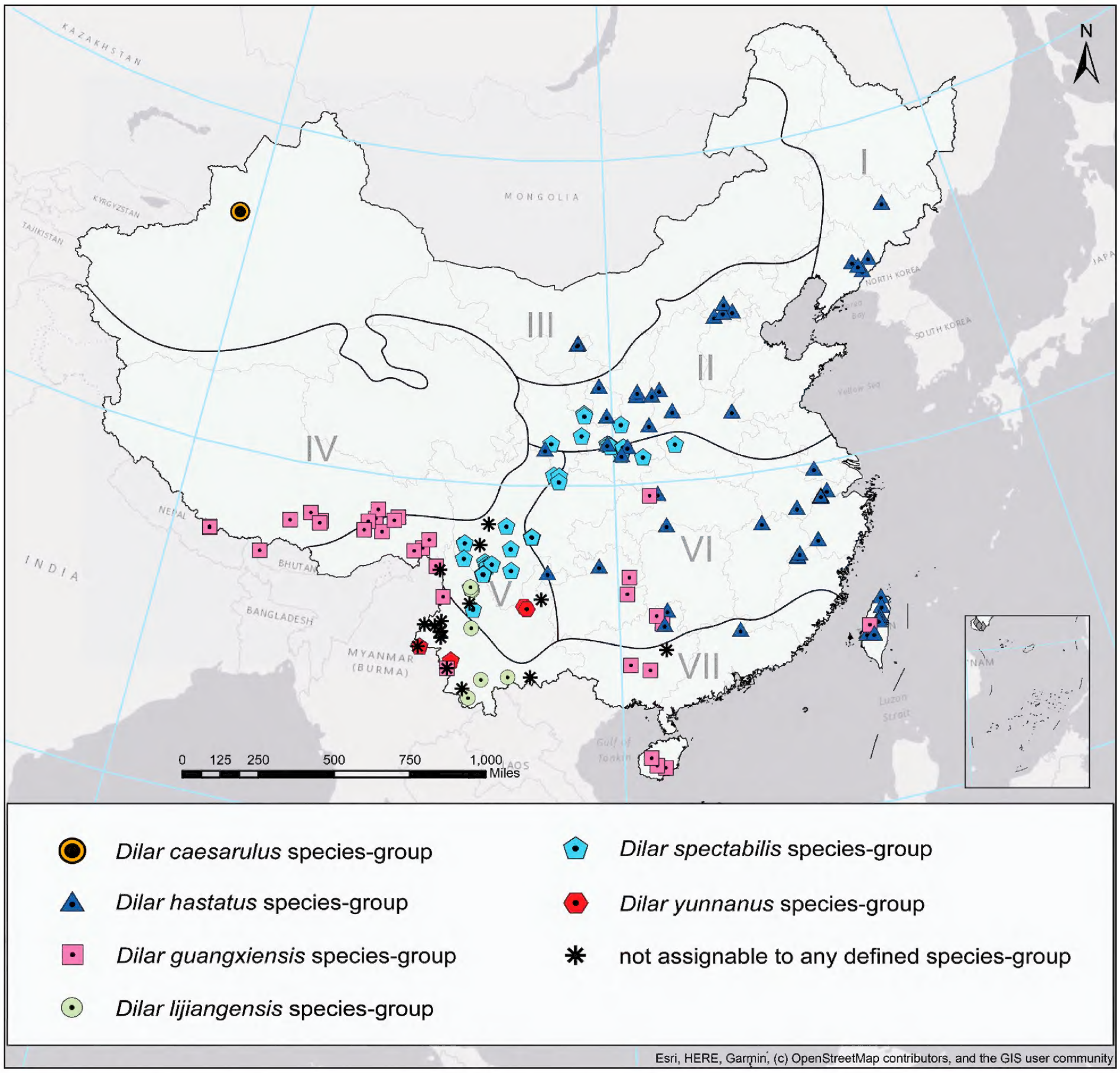

Figure 11. Distribution map of the *Dilar* species-groups in China.

be seen (Fig. 11: Region V): (i) the *D. guangxiensis* species-group is mainly found in the western and north-western parts of this region; (ii) the *D. hastatus* species-group has relatively low diversity here, with only two recorded species, both distributed near the north-eastern and eastern regional boundaries with North China Region (II) and Mid-China Region (VI), respectively; (iii) the *D. spectabilis* species-group is predominantly distributed in the central-northern and north-eastern areas of this region; (iv) the *D. lijiangensis* species-group is mainly restricted to the southwestern area of this region; (v) the *D. yunnanaus* species-group is primarily found in the central-eastern area of this region.

Mid-China Region (Region VI)

This region contains 17 species, accounting for approximately 35% of the *Dilar* fauna in China (Fig. 10: Region VI; Table 1). Three species-groups occur in this region, i.e. the *D. hastatus* species-group, the *D. spectabilis* species-group and the *D. guangxiensis* species-group (Fig. 11: Region VI; Table 2), within which the *D. hastatus* species-group is most diverse, with 12 species recorded, representing approximately 75% of all Chinese species in this group and is widely distributed across the region. The *D. spectabilis* species-group is mainly concentrated in the north-western and western areas of this region, near the borders with North China Region (II) and Mongo-Xinjiang Region (III). The *D. guangxiensis* species-group is primarily distributed in the central and southern areas of this region.

South China Region (Region VII)

This region possesses the highest endemicity, with 14 of the 17 recorded species endemic to the area, accounting for approximately 35% of the *Dilar* fauna in China (Fig. 10: Region VII; Table 1). Four species-groups are distributed in this region (Fig. 11: Region VII; Table 2).

Two of them, i.e. the *D. guangxiensis* species-group and the *D. hastatus* species-group, are primarily distributed in the central region and on the islands of Taiwan and Hainan. In contrast, the *D. lijiangensis* species-group and the *D. yunnanaus* species-group are restricted to the western part of the region, specifically in western and southern Yunnan. Notably, the species, which are difficult to assign to defined species-group, are all distributed in the South-western China Region (V) and South China Region (VII), especially Yunnan Province and the adjacent areas (Fig. 11: Region VII).

Discussion

New distribution records and taxonomic implications

The discovery of *D. lanlingensis* sp. nov. marks a renewed distribution record of *Dilar* in Jiangsu Province after a long interval since Navás (1932), who reported the species *D. subdolus*. Notably, *D. lanlingensis* sp. nov. was collected from Mt. Jintanmaoshan, Changzhou, which is geographically close to the type locality of *D. subdolus* (Chinkiang in Navás 1932; [Chen-chiang = Chenkiang, Zhenjiang]). However, as the primary type of *D. subdolus* has been lost and its original description lacks diagnostic characters (Navás 1932), this species was later designated as nomen dubium (Monserrat 1988; Zhang et al. 2015). Given this uncertainty, the possibility that *D. lanlingensis* sp. nov. is conspecific with *D. subdolus* could not be ruled out.

Another thought-provoking discovery amongst the presently described new species is the presence of a weakly-protruding posteromedial portion of the male tergum 9 in *D. lanlingensis* sp. nov. and *D. tuyuezhengi* sp. nov. (Figs 4 and 7). A similar condition has only been reported in two other Chinese species, *D. maculosus* Zhang, Liu, H. Aspöck & U. Aspöck, 2015 (Li et al. 2021: fig. 16) and *D. septentrionalis* (Zhang et al. 2014a: fig. 12). Notably, this weakly-protruding structure is often accompanied by a strongly sclerotised median area on male tergum 9, which is distinctly visible in *D. lanlingensis* sp. nov. (Fig. 4), *D. maculosus* (Li et al. 2021: fig. 16) and in *D. septentrionalis*, as confirmed through our re-examination of multiple specimens — an observation not mentioned in the original or subsequent descriptions (Navás 1912; Zhang et al. 2014a). Although the feature is not visible in *D. tuyuezhengi* sp. nov. (Fig. 7), it may have been obscured due to prolonged KOH maceration during genitalia preparation. A strongly sclerotised median area on male tergum 9 is commonly present in species with the well-developed dorsoprocessus, such as members of the *D. guangxiensis* species-group (Zhang et al. 2015; Li et al. 2021), all the Central Asian species (Li et al. 2019) and certain European species, including *D. duelli* U. Aspöck & H. Aspöck, 1995, *D. meridionalis* Hagen, 1866, *D. parthenopaeus* Costa, 1855, *D. pumilus* Navás, 1903 and *D. juniperi* Monserrat, 1988 (H. Aspöck et al. 1980; Monserrat 1988; U. Aspöck and H. Aspöck 1995; Giacomino 2016). This sclerotised area likely provides structural reinforcement for the dorsoprocessus, potentially facilitating copulatory mechanisms or species recognition. Amongst the four species exhibiting a weakly-protruding posteromedial portion of tergum 9, *D. maculosus* shares similarities in genital structures with *D. yucheni* Li, H. Aspöck, U. Aspöck & Liu, 2021 and *D. zhangweiae* Li, H. Aspöck, U. Aspöck & Liu, 2021 from the *D. guangxiensis* species-group (Li et al. 2021), while the other three all belong to the *D. hastatus* species-group. This pattern suggests that species exhibiting a weakly-protruding posteromedial portion of tergum 9, such as the *D. hastatus* species-group, may share a closer relationship with the *D. guangxiensis* species-group. Alternatively, this character may have arisen independently in different lineages. Future studies incorporating broader taxon sampling and molecular phylogenetics would be valuable in understanding the evolutionary significance of this character.

Biogeographic consideration

Currently, 95 extant species of *Dilar* have been recorded worldwide, with 49 species from China (Fig. 10). The distribution of *Dilar* species is highly unbalanced across the seven zoogeographic regions of China, with the highest species richness concentrated in Oriental China (ca. 45 species), while significantly fewer in the three regions from the Palaearctic. Southwestern China, which encompasses South-western Region (Region V) and the western part of South China Region (Region VII), appears to be the primary diversity centre for the genus, evidenced by the highest species richness with five species-groups and 24 species recorded. Notably, the species hardly assigned to any species-group are also concentrated in this area, which further supports the hypothesis that southwestern China plays a crucial role in the diversification of the genus.

The Mid-China Region (Region VI) appears to serve as another centre of diversification, particularly for the *D. hastatus* species-group, with most species primarily confined to this region. Unlike Southwest China, which acts as a primary diversification centre with high endemism, the Mid-China Region (Region VI) exhibits strong faunal affinities with adjacent regions, including North-eastern China (Region I), North China (Region II) and Taiwan Island (Region VII). This pattern suggests a range expansion of the *D. hastatus* species-group from central and eastern China. However, faunal exchange between the Mid-China Region and the adjacent South-western China Region (Region V) appears to be limited, with only a few species occurring at regional boundaries, such as *D. tuyuezhengi* sp. nov., which is restricted to the transitional zone between these two regions.

Furthermore, the species of the *D. guangxiensis* species-group are mainly distributed in southwestern China,

south part of central China and Eastern China (Regions V–VII). However, some species of this group also occur in the Qinghai-Xizang Region (Region IV), which is classified as a Palaearctic subregion (Zhang 1999). Notably, the *Dilar* species found in this region, primarily confined to the southernmost area, exhibit strong Oriental affinities, suggesting that the fauna represents an extension of the Himalayan biogeographic elements.

The complex distribution pattern of *Dilar* highlights complex historical biogeographic processes of this genus. However, the underlying mechanisms driving this pattern — such as lineage diversification, historical dispersal and ecological specialisation — remain to be elucidated through further empirical studies.

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